POST OFFICE

tele communications

JOURNAL

ONE SHILLING

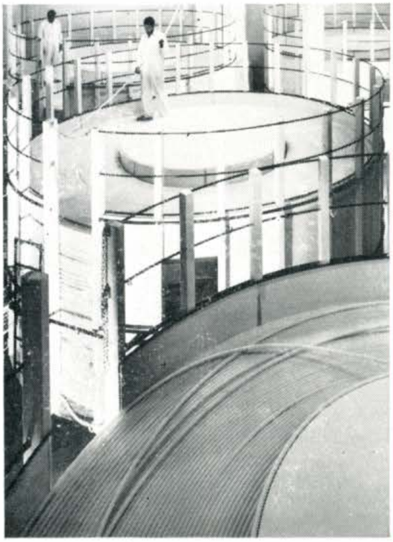
AND

SIXPENCE

SUMMER 1965

STC TELECOMMUNICATIONS REVIEW

MAY 1965



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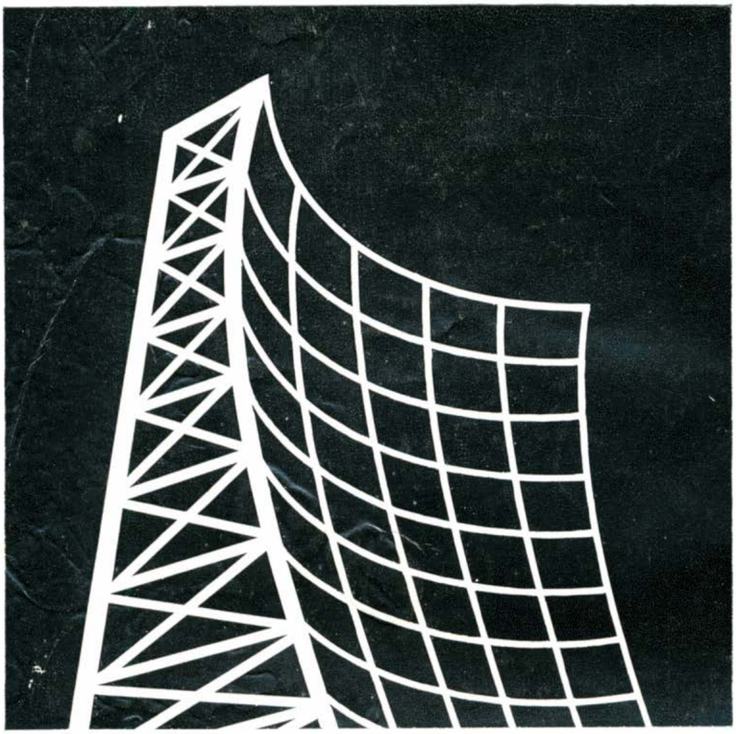

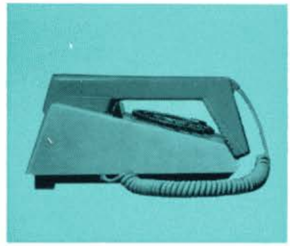

Talking Point

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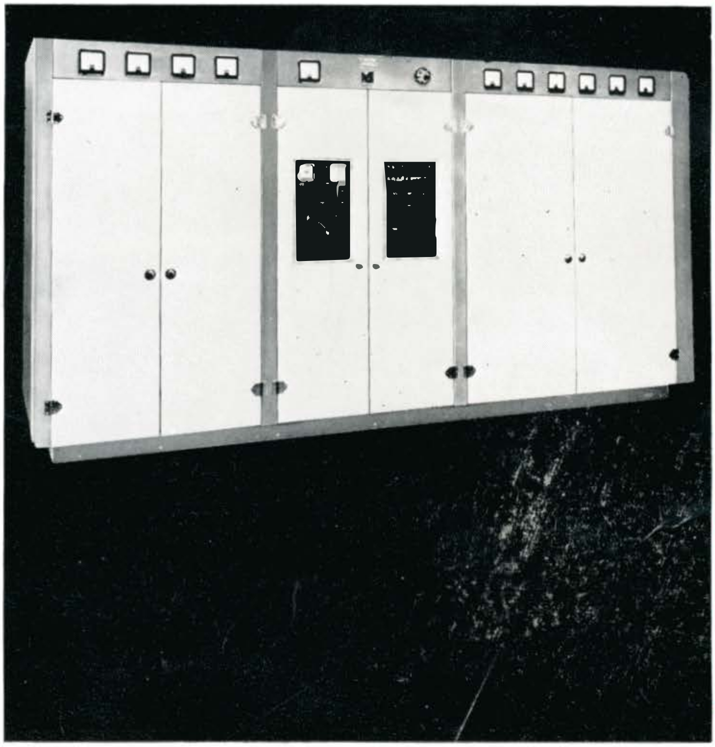

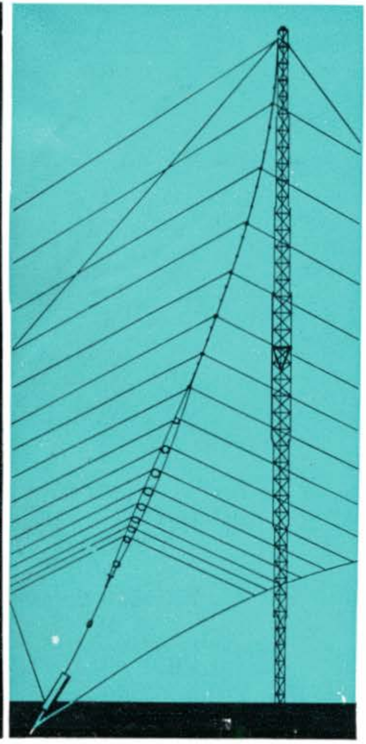

Post Office Telecommunications Journal

Published by the Post Office of the United Kingdom to promote and extend knowledge of the operation and management of telecommunications

Contents

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Vol 18 *Summer* 1965 *No.* 2

Plea for more Productivity

"ALL of us who work in telecommunications—in industry and in the Post Office—must improve the level of our productivity and increase the speed with which we meet the increasing demands if we are to succeed", said the Postmaster General, the Rt Hon Anthony Wedgwood Benn, when he recently opened a new telecommunications equipment manufacturing plant at Basildon, Essex.

The Postmaster General's challenging words highlight the unprecedented growth of the telecommunications services, which during the year ended 31 March, 1965, brought a demand for exchange connections reaching the record level of 708,000, excluding applications which were met by the take-over of telephones in situ. The number of trunk calls rose by a record 17.9 per cent to 736 million (twice the number made in 1959-60); and local calls increased by a record ten per cent to 5,600 million.

To keep pace with this demand the record number of 694,000 more exchange connections—30 per cent more than in 1963-64 were provided and by the end of March, 1965, there were nearly ten million telephones in use. Some 7,000 more trunk circuits—nearly twice as many as in 1963-64—were installed. The record sum of £150 million was spent on providing telecommunications plant for the inland service.

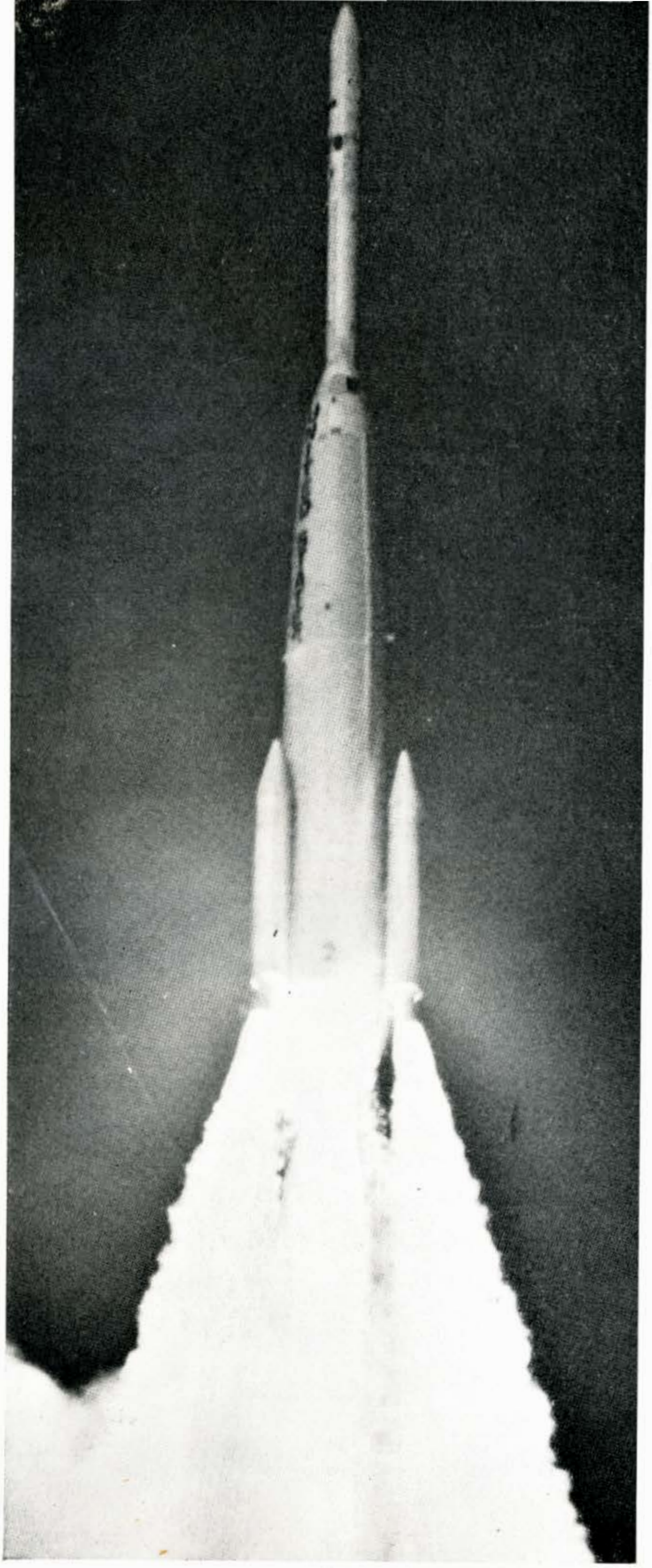
This remarkable increase in telephone business—significantly matched in many other countries as standards of living improve and the need for faster communications develops—shows every sign of continuing.

In Britain, it is estimated that demand for telephone service will rise in 1965-66 to more than a million, including more than quarter of a million applications which will be met by the take-over of telephones in situ; about a third of the applicants will be business firms. To help cope with this situation the Post Office has already made plans to provide over 800,000 new exchange connections. Plant is being greatly increased and, on the trunk side, another 8,000 circuits will be added. In the next five years an extra 54,000 trunk circuits will be provided; this is more than were provided during the past 50 years.

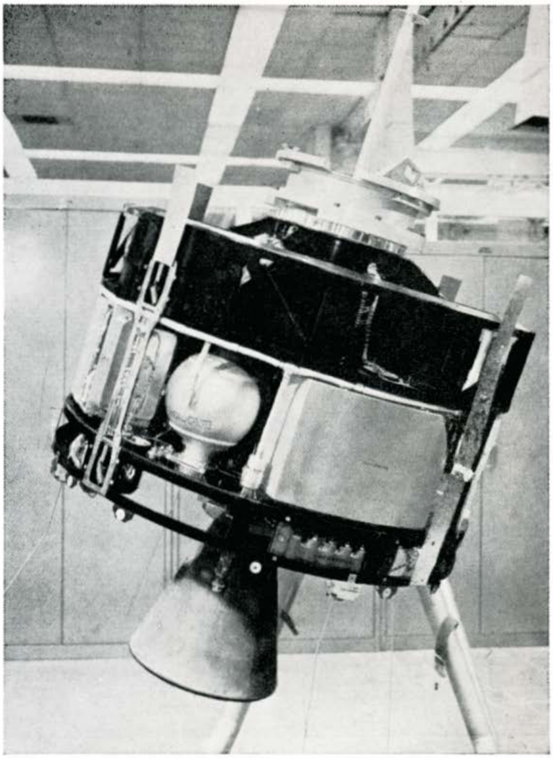
Providing more plant will not, of course, alone achieve the aim announced by the Postmaster General at Basildon of "bringing the service up to an acceptable standard wherever it is deficient and to improve the whole dynamic of the system". Above all, as the Postmaster General has said, productivity must be increased to the highest possible level.

A TELEPHONE EXCHANGE IN SPACE

Shot into space by rocket, *Early Bird* is ready to take over as the world's first commercial communications satellite. Poised 22,300 miles above the Equator, it will link Europe and North America by telephone and also be used for transmitting television programmes and exchanging telex and data messages between the two continents. A vital link in the chain is the British Post Office's earth station at Goonhilly Downs



The Delta rocket containing the two-foot high Early Bird *lifts off its platform at Cape Kennedy on 6 April.*



Above: Early Bird *unveiled to show its intricate mechanism. Right:* Early Bird, *girded with its outer coat of solar cells, is lifted to test its antenna.*

AS the *Journal* went to press the final tests were being carried out with *Early Bird*, the world's first commercial communications satellite, and the first public trans-Atlantic telephone call by way of the satellite was about to be made.

Already a number of highly successful live television programmes have been broadcast between Europe and North America via *Early Bird*. Now, the satellite and the earth stations with which it operates are ready to play their part in opening the way into the new age of space telephony.

Early Bird was launched from Cape Kennedy, in the United States, on 6 April and a week later it had been manoeuvred into its correct orbital position 22,300 miles above the Equator. Tests to determine the behaviour of the satellite's telecommunications equipment were then carried out and by the end of April the equipment at the four satellite communication ground stations—Goonhilly, in Cornwall, Andover (Maine), Pleumeur Bodou, in Brittany, and at Raisting, Western Germany—which will operate with *Early Bird* had been adjusted. Then the first of the transmission tests—including an hour-long television programme in which eleven countries on both sides of the Atlantic took part—were made. Viewers in the 24 countries which saw the television pictures were impressed with their clarity and quality.

Early Bird, is the first space venture of the international organisation set up under the satellite agreements signed in Washington in August, 1964. It is designed to provide up to 240 telephone circuits and may be available for occasional both-way television transmissions when the system is brought into commercial use. The system could provide continuous service but initially, at least, use for telephony will be restricted to the 12 hours between noon and midnight on Mondays to Fridays when trans-Atlantic traffic is at its highest peak.

Early Bird will operate at any one time between two earth stations, one on each side of the Atlantic, and in the beginning each of the three European

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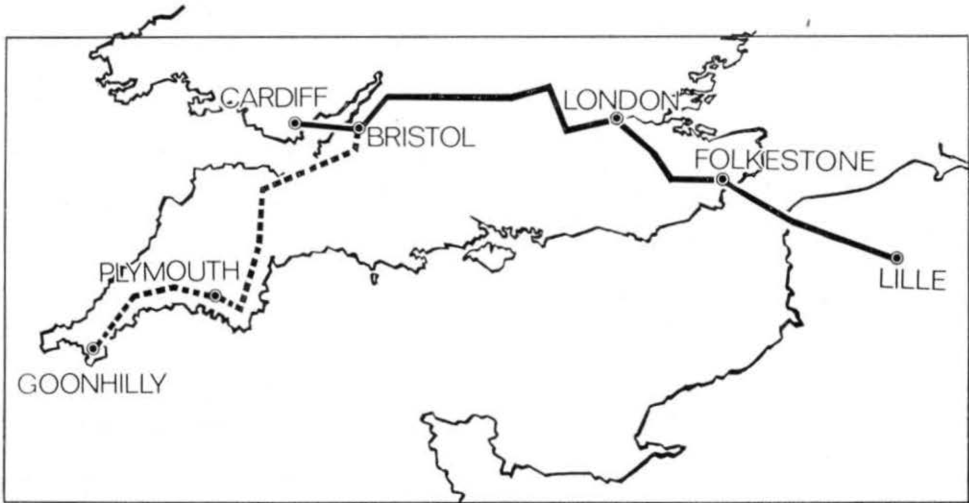
Above: **Early Bird** *undergoes a final check to its electronics system before being tested in a vacuum chamber. Right: The earth as seen by* **Early Bird** *22,300 miles up.*



This map shows how the satellite link from Goonhilly will be extended to London and then across the Channel.

The Post Office is providing new permanent both-way microwave radio relay circuits to link London with Goonhilly for carrying satellite communications traffic.

The new system, which is expected to be in service in 1966, will link the Post Office Tower in London with the Goonhilly earth station by way of Bristol and Plymouth. It will carry 960 telephone channels which can be switched to handle monochrome or colour television signals. The total length of the link will be 310 miles. Permanent microwave links are also being installed between London and France.

A HOPE FOR PEACE

"THE development of the *Early Bird* satellite is one of the most notable achievements in the history of communication," said the Postmaster General, Mr. Anthony Wedgwood Benn in a recent television interview.

"If I had described what it was ten years ago, you would have thought I was a lunatic. Here is a tiny satellite, small enough for anyone to hold in their hands, which makes direct telephone contact possible between America and Europe . . . it will provide telex links, enable computers to speak direct to computers and give a direct television link that will make it possible for simultaneous transmission of programmes across the Atlantic.

"It is almost impossible to over-estimate the significance of this for the future of man. As our system of Government rests upon an intimate structure of communication in this country, so the peace of the world depends upon the sort of understanding between man and man that these simultaneous transmissions by satellite will make possible. And I don't think it is any exaggeration to say that just as the greatest threat to mankind comes from outer space so the hope of peace comes from out of this world."

TELEPHONE EXCHANGE IN SPACE *(Contd.)*

stations will operate in turn for one week in three while one of the other two acts as a standby station and the third carries out maintenance. This arrangement will overcome the need for each station to provide its own standby facilities and enable a fully-operational system to be established as quickly as possible.

Since the three European stations will operate in this way, an inter-connecting terrestrial network of radio-relay and cable links between each earth station and its national switching centre—in London, Paris and Frankfurt respectively—has been set up. This means that the requisite number of circuits are always available at each switching centre no matter which earth station acts as the European terminal, and that traffic can be readily switched from the operational to the standby station.

Tests which have already been carried out suggest that the quality of telephone calls made via *Early Bird* will be equivalent to trans-Atlantic calls at present routed over submarine cables, although there will be a time-lag of about one-third of a second for the voice to travel the 45,000 miles from one telephone to the satellite and back to the second telephone. People on opposite sides of the Atlantic speaking to each other over the satellite's circuits will, however, be unaware whether their voices are travelling through space or being carried by submarine cable.

The British earth station at Goonhilly has been modified to enable it to take part in the first commercial satellite communications system (see article *Goonhilly in Transition* on pages 6 to 10). A second aerial is planned to be brought into operation early in 1967.

Later this year a second North American earth station will be completed in Nova Scotia and brought into the system as soon as possible.

Under the terms of the international agreements all the earth stations in the system will continue to be owned nationally but the satellite itself and the tracking, control command and related facilities will be jointly owned and operated (see article *Setting the Seal on the Satellite Pact*, Winter, 1964 issue).

Discussions are going ahead at present to decide the form of a world-wide system of commercial satellite communications. With the experience gained from *Early Bird* it is hoped to reach a decision before the end of this year.

EARLY BIRD, *which was made by the Hughes Aircraft Company of the United States and launched by a thrust-augmented Delta rocket under the control of the National Aeronautics and Space Administration, is a synchronous satellite: that is, it travels at the same speed and in the same direction of the earth's rotation and thus appears to remain stationary in the sky.*

Now stationed 22,300 miles above the Equator between Africa and Brazil, it looks down on a third of the earth's surface, an area which contains 85 per cent of the world's telephones. Only 23 inches high and 28 inches across, Early Bird looks like a huge lampshade. It weighs only 85 lb and its transmitting power is derived from the 6,000 silicon-coated solar cells which cover its outer surface.

Larger and more powerful versions of Early Bird designed to provide 1,000 simultaneous telephone circuits are now being built.

GOONHILLY IN TRANSITION

By D. WRAY

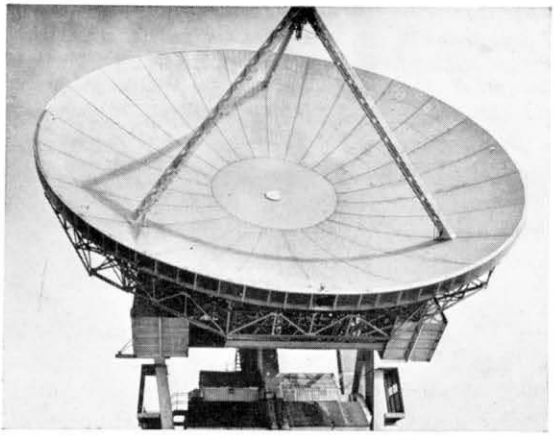
So that Britain can take part in the world's first commercial satellite communications system, the Post Office earth station at Goonhilly Downs has been almost completely rebuilt. This article tells why and how the task has been done

One of the 30-ft long petals for the new parabolic dish aerial is hoisted into place.

IT is now nearly three years since *Telstar* dramatically demonstrated the potentialities of satellites for long-distance communications by carrying high-definition television across the Atlantic.

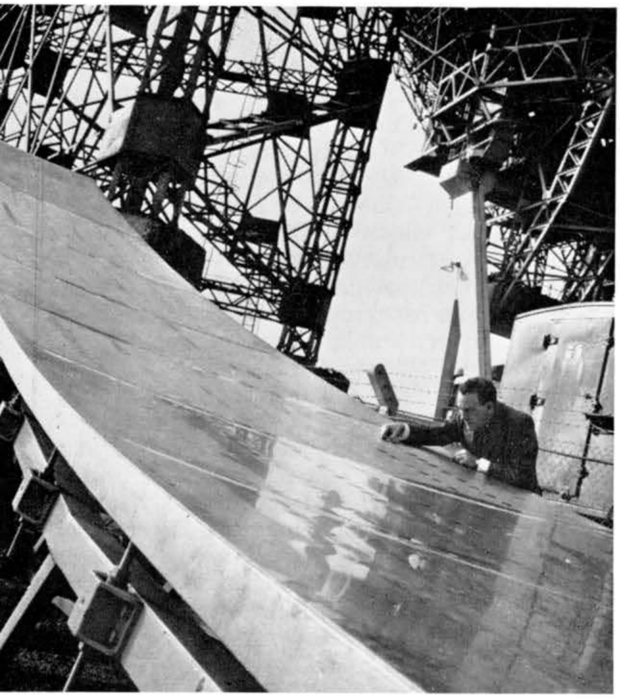
To those of us who acted as doctors, midwives, or merely runners-for-hot-water during the birth of this baby technology, the first few nights of the *Telstar* transmissions will probably stay longer in the memory than the later, and more technically assured, programmes carried by *Telstar I* and *II*, the two *Relays*, and the *Syncom* coverage of the Olympic Games.

Nowadays, the launching of a new communications satellite does not engender much excitement; as far as the public is concerned, the glamour has



◀ ***NEW: The new dish aerial, looking like a gigantic daisy, is shallower than the old aerial.***

OLD: ▶ ***The original aerial which was used to send and receive messages by way of the*** **Telstar** ***and*** **Relay** ***satellites.***



Assistant Engineer B. Oakes carefully measures the reflector surface of a petal.

worn thin. So the advent of *HS-303*—or *Early Bird* as it is less prosaically called—may not arouse as much public interest as *Telstar* did. But for the telecommunications engineer, this is one of the most interesting satellites of all, for *HS-303* is intended, following a period of intensive inter-earth station tests, to carry commercial telephony traffic and to take its place, side by side with submarine cables, in the world's international communications network.

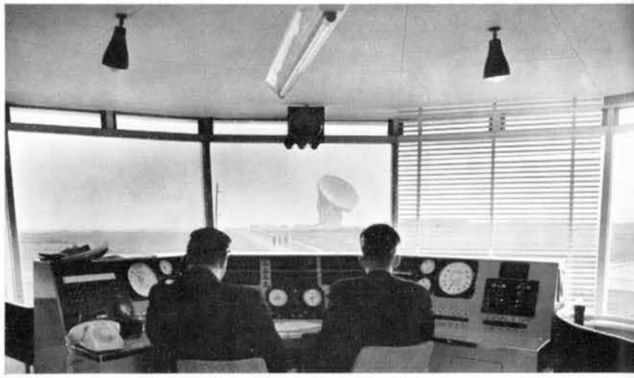
Telstar and *Relay* were both launched into highly elliptical orbits, with the plane of the ellipse steeply inclined to the equatorial plane. As a result the majority of their orbits were quite useless for radio communication across the North Atlantic. A typical day in the life of *Telstar* would contain nine orbits of which three, separated by two-and-a half hours or so, could be used for North Atlantic transmissions of about half-an-hour's duration. A television programme or a technical test could be snatched from the air during one of these fleeting appearances, but a continuous commercial telephony system was clearly impossible.

HS-303, on the other hand, is one of the *Syncom* class of satellites and has the property, possessed by this class as a whole, of being able to hover over one part of the Earth. This is accomplished by launching the satellite to a height of 22,300 miles above the Equator where it has an orbital period of one day, the same as that of the Earth. The satellite, therefore, appears to be almost stationary in the sky and can provide uninterrupted radio connections—and hence a telephone service—to almost a third of the Earth's surface.

During the last few months, the three earth stations that took part in the original *Telstar* experiment (Andover in the United States; Pleumeur Bodou in France; and Goonhilly in Britain) have been modified in readiness for the *HS-303* project, and earth stations in Germany, Italy and Canada were also preparing to take part. At first sight, it would seem to be an easy matter to change from working from one satellite to another, but at Goonhilly, for example, every item of the

OVER

***Left:** Checking the accuracy of a petal by floodlight. The light reveals any irregularities in the reflector surface.*
***Below:** A view of the new aerial at Goonhilly seen from the earth station's control tower.*



GOONHILLY *(Contd.)*
installation, with the exception of the computer, has had to be extensively modified or replaced by new equipment; and even the computer needs a new programme. Many of these modifications were necessary because the characteristics of the debutante satellite are different from its predecessors; but the opportunity is also being taken of introducing changes to equipment where past experience has shown that improvements are possible, perhaps in operational simplicity, or in reliability, or in technical performance, or all three.

For one thing, the radio frequencies employed by *HS-303* are not the same as those used by previous satellites. This change is necessary because *Telstar II* and *Relay I* and *II* are still operational and to use their frequencies would risk interference and misoperation. The original *Telstar* transmitter at Goonhilly has, therefore, been modified so that it can transmit on either the *Telstar* or the *HS-303* frequency. The output valve in this transmitter is a newly-developed travelling wave tube capable of delivering more than eight kilowatts at 6,300 megacycles. Such a power may not seem much when compared with the powers generated by broadcasting stations, but the production of high powers becomes immensely more difficult as the frequency is increased, and the Goonhilly transmitter will be the most powerful in the world at this frequency.

At the other end of the power scale, the power received from the satellite is incredibly tiny—far less than a millionth of a millionth of a watt. To receive and amplify such minute signals, an extremely sensitive device is required that will not only boost these radio waves from space to a usable level but will refrain from swamping them with its own molecular agitation.

This is where the maser plays its part. The maser is a somewhat esoteric device consisting of a ruby crystal placed within a strong magnetic field and immersed in a liquid helium (the coldest substance in existence) at a temperature of 270°C *below zero*. A maser cannot be so readily tuned as a transmitter, so separate masers are required for *HS-303* and *Telstar*; in fact, two new identical masers for *HS-303* are being provided at Goonhilly, and two new cabins—not much larger than sentry-boxes—have been built into the girders behind the giant steerable aerial to house them. These new masers are particularly interesting in that they employ the principle of superconductivity in obtaining their magnetic field. A coil of wire, when immersed in liquid helium, loses all signs of electrical resistance, so a current induced into it will circulate and produce a magnetic field for ever without diminution.

Corresponding modifications have also been made to all the other radio apparatus in the station. Modulators and demodulators, amplifiers and beacon receivers, and the hundred-and-one pieces of test apparatus have been replaced or altered, and a new terrestrial communications link, suitable for multi-channel telephony, has been

provided between Goonhilly and London. But perhaps the most obvious and spectacular change is that to the great steerable aerial.

The parabolic dish type of aerial used at Goonhilly can be likened to the mirror reflector of a searchlight or a car headlight in which the source of light at the focus is converted into a narrow beam of light after reflection from the mirror. In an aerial, there is, of course, no lamp at the focus but a source of radio energy (known as the "feed"), and the system works two ways; that is, besides producing a narrow beam of transmitted power, radio signals from a distant point arriving at the reflector are concentrated on to the focus where they can be led to the maser receiver. If, because of manufacturing imperfections, there are any departures from a true parabolic shape in the reflector, then the beam is slightly defocussed, and the aerial is not so efficient as it could be in producing a pencil beam of transmitted power or in receiving the maximum possible amount of power from the satellite. The original Goonhilly aerial has been perfectly satisfactory in handling the signals from *Telstar* and *Relay*, but *HS-303* is five or six times more distant than these earlier satellites and a very much higher degree of precision is called for in the construction of the

OVER

Syncom III, *the world's first "stationary" satellite which was launched by the Americans from Cape Kennedy on 19 August, 1964, is in such a precise orbit that its rotational speed almost perfectly matches that of the earth.*

The earth revolves at the rate of 1,436.069 minutes every day. Syncom III *revolves at 1,436.158 minutes a day—only five seconds faster. The position of* Syncom III, *22,300 miles over the equator, is relatively motionless, drifting less than a mile and a half, or one-hundreth of a degree a day.*

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Relay I, *the American satellite which was designed to "live" for only 12 months, celebrated its second birthday on 13 December, 1964, and is still being used to transmit experimental television, telegraph and telephone messages.*

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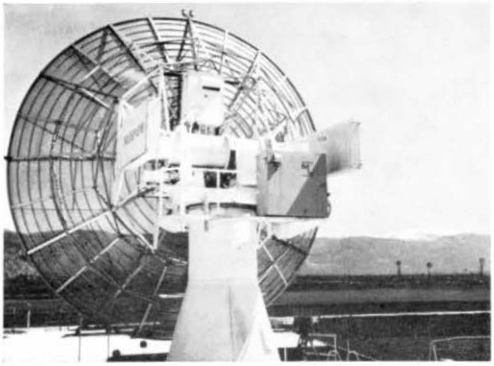
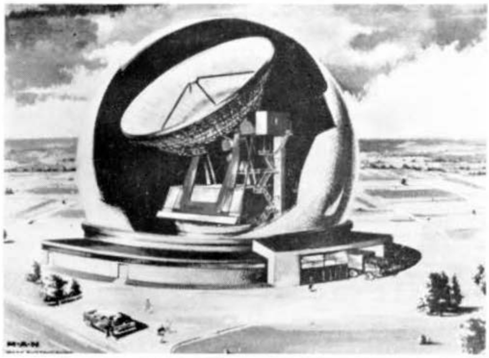
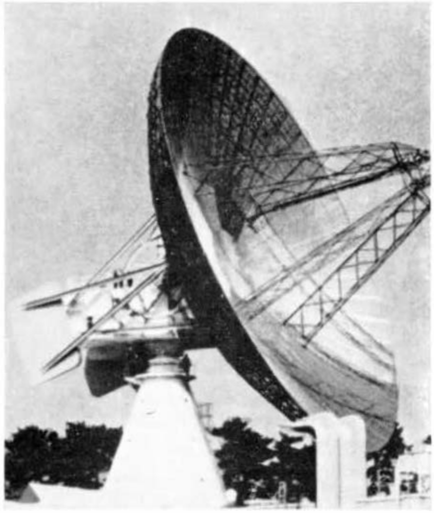
Relay II, *launched on 21 January, 1963, has now travelled more than 120 million miles and been used to carry out nearly 2,000 experimental transmissions, including broadcasts of the Olympic Games in Tokio.*

In the control building engineers at work at a bank of consoles which control the transmitting and reception systems.







Earth stations in other parts of the world, all bearing a close resemblance to the Goonhilly dish system. Top left: Rao, in Sweden. This aerial is used for both satellite communications experiments and for radio astronomy observations. Bottom left: Fucino, Italy. Top right: Raisting, Western Germany; and bottom right: Kokunbunji, Japan.

GOONHILLY (*Concluded*)

aerial. Consequently, a complete new reflector surface, rather shallower than before, has been added to the 85 ft diameter aerial. This consists of a central parabolic dish, about 25 ft in diameter, made up from four quadrants, but accurately machined as one piece, surrounded by 24 petals each 30 ft long and subtending an angle of 15° to the aerial. The result gives the appearance of a gigantic steel daisy. Each of the peripheral petals has a substantial girder-backing structure topped with curved stainless-steel plates welded to supporting trays that were shaped by automatic machine tools under the control of a computer-produced magnetic tape. The aim has been to make the central dish and the surrounding petals accurate to within 50-thousandths of an inch of a geometrically-perfect paraboloid. The original four-legged feed support has been replaced by a slender tripod so designed that every plate in its construction is parallel with the axis of the aerial, thus reducing shadowing of the reflector surface to a minimum.

Once again, Goonhilly has found itself involved in a large programme of work, much of it butting hard against the frontiers of technical knowledge, and with very little time in which to carry it out. No praise is too high for the many men, both from the contractors' companies and from within the Post Office, who have worked long hours through strong and bitterly cold winds to complete their tasks in time.

THE AUTHOR

Mr. D. Wray joined the Post Office as a Youth-in-Training in 1940. Six years later he was appointed an Executive Engineer (new style) at the Research Station at Dollis Hill where he worked on coaxial cable systems, television transmission and microwave radio development. In 1957 he became Senior Executive Engineer in the LMD Branch and was responsible for the operation and maintenance of television links for the BBC and ITA. He went to Imperial Chemical Industries in 1959 under the exchange-with-industry scheme and returned in 1960 to take up the post of Senior Executive Engineer in the Technical Support Unit where he was responsible for investigating digital computers and liaising with other Government Departments on automatic data processing techniques. Since 1962 Mr. Wray has been Assistant Staff Engineer in the Space Communications Systems Branch, being responsible for the provision and maintenance of the Goonhilly Satellite Communications Station.

MARKETING THE TELEPHONE

★

"Times are changing . . . and we are preparing for the day when we can take the initiative with sales of apparatus and facilities to our telephone customers," says the head of the Post Office's new Marketing Branch. This article tells how the new Branch will tackle its formidable tasks and so help to provide the best possible service.

FOR the first time in many years the Post Office is preparing for the day when it can go out and *sell* facilities to its telephone customers, says Mr. R. Martin, Assistant Secretary in charge of the newly formed Marketing Branch in the Inland Telecommunications Department.

Mr. Martin, speaking at a Post Office Headquarters lecture on the reasons for setting up the Marketing Branch and the challenges which it will have to meet, said that probably nobody under the age of 40 had worked in the Post Office at a time when it was actively trying to promote the telephone service.

There were reasons for this state of affairs, of course. During and since World War Two spontaneous demand for telephone service had exceeded the money and manpower resources available to the Post Office and priority had to be given to meeting that demand. This, and the provision of a good quality of service for existing customers will always be a first charge on Post Office resources, but the enforced austerity of past years had been bad in a number of ways: for the customers because they had been denied the opportunity to use the most modern equipment; for the public image of the Post Office since it has appeared in its customers' apparatus to lag behind the most progressive telephone systems; and for the finances of the Post Office in that the variety of additional and optional facilities helps to produce revenues for financing the further expansion of the service.

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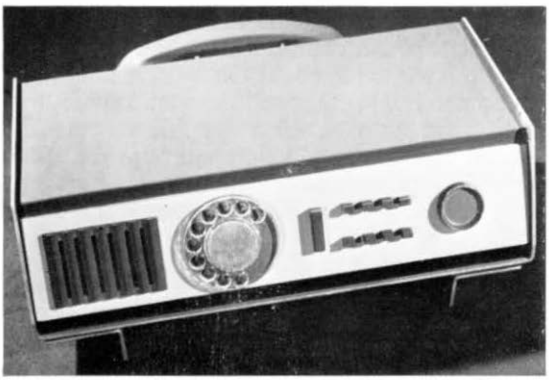
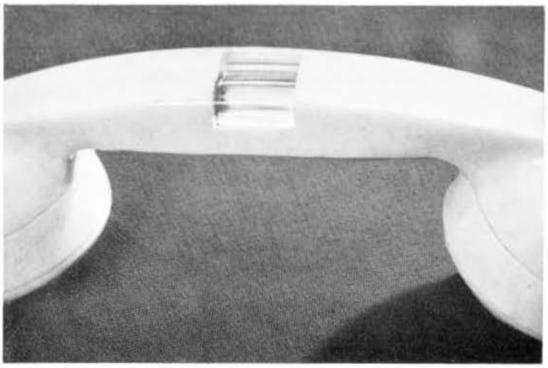


A design model of the new voice-switched Loudspeaking telephone No. 4 which is soon to go into production.

Experimental press-button telephone (the final version will not necessarily look like this) to be introduced soon.



Above: The new handset No. 7 with the neon ringing indicator. Below: The new Trimphone.

Above: The cordless 3 plus 9 PMBX which was introduced in 1915. Below: The new Lamp Signalling 1 plus 12 PMBX system.

MARKETING THE TELEPHONE (*Contd.*)

"Times are changing," said Mr. Martin. "Today, with a vigorous programme of expansion, we are able to prepare for the day when we can supplement our other tasks and take the initiative with sales of apparatus and facilities to our customers."

The recently formed Marketing Branch had four main aims. First, to keep apparatus up to date in appearance as well as in performance; second, to anticipate the devices and facilities which customers are likely to need in the coming years so that they will be ready when required; third, to ensure that customers know what facilities are available; and fourth, to obtain the maximum possible revenue from the sale of profitable optional extras and thus help to keep basic telephone prices low.

It had not been possible until about ten years ago to do much about modernising customer apparatus but the first stage of post-war modernisation had now been completed. Ten years was a long time but it had to be remembered that it might well take between four and five years to develop a piece of apparatus from the time it was decided to do something about it until the first batches of the saleable article began to be mass-produced. Ideas had first to be collected, then sifted and analysed for feasibility and cost and attractiveness to the customer before even an outline specification could be drawn up. After that the engineers and manufacturers had to turn the specification into something that worked and which was economical to make and then, when prototype models had been tested and approved and the Council of Industrial Design had been consulted about the appearance of the article, a manufacturer had to make his mass-production tools, set up his assembly lines and train his workers.

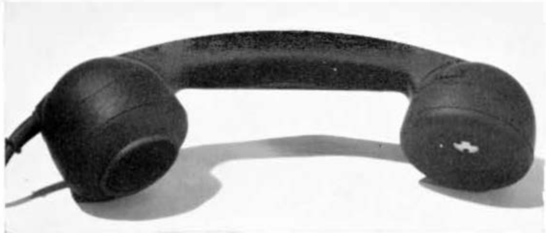
"We are, of course, aiming to reduce these times, but even so they will still be quite lengthy," added Mr. Martin. "The process of bringing apparatus up to date will continue as technical innovations come along that will improve performance or reduce costs or as fashions in appearance change."

It was important that the Marketing Branch

should be thinking now of the kind of apparatus which customers will be asking for in, say, five years time. Since most customers did not know at this stage what they would be wanting so far ahead, the Marketing Branch would have to use a combination of imagination and market research to find the answers—imagination to visualise the sort of thing that might be possible, attractive and useful; and market research to find out if it would appeal to the customers.

A small, but growing and very keen market research section had been set up in the Marketing Branch and it would tackle this particular problem in three ways. First, it would study the inquiries and requests for non-standard facilities which the Post Office received from customers for signs of requirements that might meet a general need. For example, there had been a number of recent requests from big business firms for conference loud-speaking telephone facilities. These requests had been met by specially-engineered arrangements on each occasion but the idea was catching on so rapidly that the Engineering Department was now developing a standard system which could be rented quite cheaply and brought into use whenever a customer wished and without the engineers being needed to carry out any further work.

The second approach was to take ideas for future apparatus or facilities—if possible those developed to the working model stage—direct to the customer and see how he reacted to them. This was not quite as easy as it sounded, however, because working models in advance of mass production could be highly expensive. But the technique had already been used in the case of Trimphone (the new, more compact telephone which had an illuminated dial and gave a tone-calling signal instead of the traditional bell ring) when wooden models were put on display at sales offices in various parts of the country to assess customer reaction. The system was also being used in a market research study for repertory diallers, instruments on which a selection of telephone numbers can be pre-recorded and then dialled at the touch of a button. Since no models of the repertory diallers are available in this country the Post Office had bought a number of instruments from the United States and sent them out to selected customers for trial. In this way the Post Office was trying to assess whether an idea was attractive enough to customers to make it worth while pursuing and, at the same time, getting a



Above: The modern amplifying telephone, showing the volume control on the side of the earpiece. Below: The old-style telephone with deaf-aid amplifier.

rough estimate of the size of the market that might be expected.

The third line of approach—perhaps the one which would help the most in looking into the future—was to go out and study the use which customers made of their telephone installations, what their problems were and how far the Post Office could help by improving apparatus or facilities. At the present time a study was being planned of the use made of extension plan arrangements and small switching systems generally. The popularity of each extension plan or small switchboard was already known, but the Post Office did not know how far customers were fitting their needs into the Procrustean beds of its standard facilities nor how much better their needs might be met by re-arranging the standard pattern of facilities or by introducing new ones.

OVER

Above: The modern Keymaster house exchange system 2 plus 10 to be introduced soon. Right: The old-style house exchange 2 plus 10 which was introduced in 1935.

MARKETING THE TELEPHONE (*Concluded*)

The Marketing Branch was also aiming to carry out studies to find out the special needs of particular industries, such as hotels and banking, and how best the Post Office could help.

"When market research has established the need for a new item and all the processes have been completed to bring it to the stage of quantity production, the problems of deciding how many to manufacture and how to place them on the market remain," said Mr. Martin. "Initial market research with models and questionnaires can give a rough idea of the probable size of the market, but only a very rough one. In the circumstances of the past we have tended to make an intelligent guess at the quantities that might be needed, put them into stock, tell the staff about them and wait and see what happened. Generally this worked out; but occasionally demand greatly exceeded expectations and we were faced with a national shortage which could not be relieved until fresh production could be obtained.

"If, in the future, we are to be more active in bringing new apparatus to the notice of our customers, the risks and consequences of miscalculating the market will be much more severe. To avoid this, we are planning to take a small batch of the initial production of a new item and release it to a very limited area for test marketing. In the selected area we would use all our normal selling methods so that we could test our penetration of the market under realistic selling conditions. From this we could then make a much more reliable estimate of the national market. This would then tell us the total stocks and the rate of supply that we should need, but stocks still have to be built up and we should have to decide whether we were going to wait, possibly for a year or more, until stocks were large enough to launch the item nationally, or whether we would introduce it, say, an Area at a time as supplies built up.

"This technique of gradual introduction would be new for the Post Office although it is not uncommon in industry and commerce. It could be rewarding both for us and our customers, especially if we are able to combine active selling of the item in those areas where it has been publicly introduced with a facility for meeting unsolicited orders elsewhere. We have a lot to learn about these techniques but it may be that we shall be able to try them out with Trimphone.

"All of us, and not least the Sales staffs, are looking forward to the day when we can be more active in selling our big range of useful products to our customers—not by high-pressure salesmanship but simply by making sure that the customer is told and shown attractively all there is for him to have and advised what will best suit his requirements.

"A great deal of this is already being done in the business field since our Sales staffs are usually actively concerned in the design of larger installations. To a limited extent it is also being done in the residence market where Sales Office staff have

been offering the choice of modern coloured telephones to customers placing orders for new lines or other work. Despite the fact that the modern telephone carries a small extra initial charge, 82 per cent of all new telephones supplied are now modern ones.

"We have attractive sales leaflets about the modern telephone but, as supplies of other items build up and the expansion programme develops, we intend to produce more comprehensive brochures and catalogues designed to interest different groups of customers in wider ranges of apparatus planned to meet their needs and desires."

As a result of a sample survey undertaken in September, 1964, it is estimated that 42 per cent of telephones used by residential subscribers are residential modern instruments. One-third of these modern instruments are black, one-third ivory and the remainder in a selection of other colours.

★

THE TEN MILLIONTH TELEPHONE

ONE of the wedding gifts which Mr. and Mrs. G. W. Byers, of 114, Goldhurst Terrace, Hampstead, will most treasure is the telephone which was presented to them by the Postmaster General a few days before their marriage in May.

It was the ten millionth telephone to be installed in Britain and the first of the new Trimphones—the lightweight, luxury phone with an illuminated dial and the warbling calling signal.

Making the presentation, the Postmaster General said that the ceremony was an important landmark in the development of the telephone service which was growing at an unprecedented rate. In 1922 there were one million telephones in Britain, by 1932 there were two million and by 1950 five million. The number had been doubled in the last 15 years and now a whole new generation was growing up which regarded the telephone as essential. Today only the United States and Japan had more telephones than Britain and both these countries had much larger populations. In 1964-65 the Post Office had supplied the record number of 690,000 telephones. Next year the demand and supply figures would be even higher.

The Trimphone is more compact than any of its ancestors, measuring 7½ inches long, 4½ inches wide and 4 inches in height. It weighs only 2 lb 5 ozs, compared with the 4 lb 1 oz of the 700 type. The lever on which the ear-and-mouth piece rests rises when the telephone is in use, to form a handle by which the instrument can be carried around a room. The ear-and-mouth piece hangs over the front of the instrument. The warbling tone is produced by a transistorised oscillator connected to a miniature loudspeaker and by operating a volume control in the base of the instrument the user can adjust the calling signal from a soft tone through medium to loud. The illuminated dial provides sufficient light to enable the dial figures and letters to be read in the dark.

The Postmaster General presents the ten-millionth telephone to the happy couple at a ceremony held in Hampstead Town Hall.

Trimphone will first be available to subscribers in the London North-West Telephone Area and it is hoped to make it available throughout the country—in three colour combinations—during 1966.

The message contained in this year's Post Office Prospects White Paper is...

EXPANSION—And Better Things To Come

A STORY of continuing growth of the telecommunications services and of future plans for further expansion and development is told in the White Paper *Post Office Prospects, 1965-66,* which was presented to Parliament by the Postmaster General on 24 March.

Telephone and telex traffic continue to grow rapidly both in the home and in the overseas service, says the White Paper. Inland trunk telephone calls are increasing by about 17 per cent a year and local calls by between 8-9 per cent, while inland telex calls are going up by some 25 per cent a year. The annual rate of increase for both telephone and telex traffic in the overseas service is about 15 per cent a year.

● Quality of service

Although the quality of the inland telephone service is satisfactory in many places, it is not as good everywhere as it should be, notably in London and the South East. In some places traffic has outstripped the capacity of the system and there are some staff shortages. However, plant is being augmented as quickly as possible, although installation work itself impairs the service while it is being carried out. Nevertheless, improvements are being made and are expected to continue in 1965-66.

● How the System is Growing

The trunk network is being expanded to cater for the rapidly increasing number of trunk calls and about 8,000 more trunk circuits will be added to the system in the coming year. During 1965-66 contractors will begin installing telephone switching equipment at some 155 new exchanges and work will start on extending about 330 existing exchanges to provide for the expansion of the inland telephone service and its modernisation. This programme will include three new major trunk exchanges and almost 100 conversions from manual to automatic working. Additionally, Post Office staff will carry out many equipment extensions and conversions at smaller exchanges.

To meet the new demands for service and also to provide for people already waiting, an additional 600,000 lines in the local cable network connecting subscribers' premises with exchanges are planned. This represents a bigger increase to the number of lines than has ever been provided before in one year. Together with those lines made available when customers move or give up their telephones, this expansion should provide enough line plant to give service to more than a million applicants in the coming year.

● Speeding Provision

It is expected that orders for some 1.09 million connections will be met in 1965-66—810,000 by new provision and 280,000 by the 'take-over' of existing installations. Of these some 305,000 will be business subscribers and 785,000 residential subscribers. The total number of connections is expected to rise from 5,884,000 on 1 April, 1965, to 6,394,000 by 31 March, 1966, and the corresponding number of telephones, including extensions, will be about 10¾ million by the same date.

The waiting list, which stood at just under 46,000 on 31 December, 1964, has been held steady for 12 months in spite of the fact that the system had grown by 35,000 more exchange connections than had been expected. The number of applicants waiting only for lines to the exchange had been reduced by about 12,000 but this improvement was offset by more applicants waiting for exchange equipment. In the coming year the capacity of many exchanges will be substantially increased and plans are being reviewed to see what can be done to provide for the much higher rates of growth now being experienced in the context of the aim of virtually eliminating the waiting list by March, 1966.

The telex service had over 14,500 lines at the

beginning of 1965-66 and about 3,200 more will be added during the year. The Datel services which provide facilities for data to be sent to computers over telephone and telegraph circuits will be expanded and new facilities will be developed.

Future Development

Discussing the Post Office's plans for future development, the White Paper says that the automatisation programme for the telephone service continues to make good progress towards completion by 1970. On average two manual exchanges were being converted to automatic working every week so that by March, 1966, the number of manual exchanges remaining in the country will be reduced to about 320. Automatic service will then be available to 94 per cent of all subscribers and about 60 per cent will have trunk dialling facilities.

It is hoped to start work on buildings for 160 new telephone exchanges and 20 more engineering centres. Wherever possible standard type buildings which save planning and construction costs will be provided.

The first link in the microwave radio system, of which the Post Office Tower in London is the focal point, is expected to be brought into service in the near future. Considerable progress is also being made on electronic exchange systems. Electronic equipment designed for use in small exchanges has been installed at Leamington and Peterborough and will be on trial during 1965. A larger electronic exchange is being installed at Leighton Buzzard and this will be brought into public service early in 1966.

On the overseas side, mechanisation and decentralisation of telegraph operating work will continue and thus ease staffing problems and improve the standard of service. In spite of the rapid growth of telex traffic and private leased circuits, overseas telegraph traffic is maintaining its level.

A number of new overseas telex services will shortly be introduced, notably with Burma, Egypt, Doha, Macau, Libya, Turkey, Cyprus and Syria, and international subscriber dialling will be extended to Spain, Portugal, Canada, New Zealand and Australia.

The Commonwealth South East Asia cable (SEACOM) system linking Malaysia with Hong Kong and Australia, will be completed by the end of 1966. The first two sections—between Singapore and Sabah and between Sabah and Hong Kong—are already open for service.

Great Britain now has a share in the ownership and management of the space segment of a global satellite system and is represented on an international committee in Washington which controls the project. The committee plan to bring into operation by the end of 1967 a satellite system which will give the elements of a global system. Meanwhile a single synchronous satellite—*Early Bird*, or *HS-303* (see pages 2, 10) was due to be launched to carry experimentally an element of commercial telephone (and possibly television) traffic, and the Post Office will be taking part in these experiments through its Satellite Ground Station at Goonhilly.

Staff

On staffing, the White Paper says that the number of inland exchange operators has remained fairly constant during the year. Increases of staff needed to handle the growth of traffic had been largely offset by savings achieved from the conversion of manual exchanges to automatic working and the extension of Subscriber Trunk Dialling. In the coming year these influences should produce a slight decrease in staff. The engineering construction and maintenance force increased by about 6,000 during 1964-65 and is expected to increase by a further 3,500 in 1965-66.

Capital Expenditure

Capital requirements in the telecommunications sector during 1965-66 were expected to amount to £219 million—an increase of £43 million compared with 1964-65. This amount will be financed partly by borrowing £102 million from the Exchequer; partly from an estimated profit of £35 million during the year and the balance of £82 million from depreciation provision.

"In essence the postal and telecommunications services . . . are two great industries with very different characteristics and meeting different needs," says the White Paper. "To a large degree they are run separately, with different staffs and management and separate accounts are presented. It would not make economic sense for the postal services to be subsidised by the telecommunications services or vice versa. The right pricing policy should be adopted for both."

Post Office cabling gangs are using two-way radio sets to speed their work, reduce effort and lower costs. The new radio sets have an operating range of 800 yards in built-up areas and up to three miles in open country

TWO-WAY RADIO CUTS CABLING COSTS

As polythene cable is fed into a duct section from an 8-ft diameter drum, the cabling gang listens to instructions passed over the transceiver (seen bottom left).

PORTABLE, two-way radio sets, or transceivers, are being used increasingly by external cabling gangs to provide them with instant and continuous communication between the cable drum and winch when drawing long lengths of the new lightweight telephone cable into underground ducts. An extra transceiver can be used to check the progress of the cable end through an intermediate joint box or manhole on the duct route.

As a result considerable savings are being achieved in both time and effort and overall cabling costs are being reduced.

The radio sets, which operate from internal dry cells, are robust and simple to handle. The operating controls include a folding aerial and volume control, a small voltmeter to indicate the state of the battery and a handset with a press-to-talk switch. A small loudspeaker can be switched on when calls are expected, or a separate earphone

By D. E. KENNARD

can be used to receive messages while leaving the hands free for cabling work.

Some form of inter-communication is necessary on any cabling scheme. To pull a cable into a duct between two jointing points, a steel rod is pushed from one end to the other and is then connected to a temporary plastic rope or the steel cabling rope. The rod is then withdrawn, leaving the rope in position.* When the cable-drum is ready, the steel rope is coupled to the cable and pulled through the duct route, leaving the cable in place. In such operations the type of communication used will depend on the distance between the joint boxes, which in turn will depend on the layout of the duct route and on the type of cable drawn in.

When short lengths of cable are laid, the drum and winch are usually in sight of each other and messages are passed by hand signals, extra men being positioned at obstructions or bends in roads to relay them. However, this method is not always satisfactory should difficulties occur at the drum, since it may be necessary to stop the winch immediately. Hand signals are not acceptable over longer distances because of the number of men needed to relay messages and the delay involved in passing them.

In the local line network, cables with polythene sheaths instead of lead sheaths are being increasingly used (*see the article The Dover to Deal Experiment—Winter Issue, 1963*).

One advantage of the new type of sheath is that it reduces the cable weight to about 45 per cent of the earlier type. Typical weights of lead-sheathed and polythene-sheathed cables for a 1,000-pair cable are 20.8 lb/yard and 9.8 lb/yard respectively. Because of this, longer lengths can be installed—usually between three to five times those of a lead-sheathed cable.

The length of new cable which can be pulled into a duct route is, of course, limited by the amount that can be stored on a drum, the breaking strength of the cable, the position of any spur cables to be jointed to the cable and the straightness of the duct route. Lead-sheathed subscribers' cables are generally installed in lengths of between 50 to 180 yards. Polythene-sheathed cables, however, can be installed in lengths of between 500 to 1,000 yards, depending on size.

As the cable end passes through an intermediate jointing box a member of the cabling gang reports progress.

Often a joint can be saved at a point where the duct route takes a sharp bend by feeding part of the cable beyond the bend. For this operation the drum is first set up at a jointing point on the bend, one section is installed in one direction as before and then the winch is moved to another point beyond the drum. The rest of the cable is taken off the drum without being cut and laid in figure-of-eight loops. The free end is then coupled to another cabling rope drawn into the duct route in the other direction. Continuous communication is essential during the final stages of this operation to prevent the cable being damaged while the last loop is lowered into position. Using this method, the distance between joints on medium-sized cables can be increased to 1,500 yards or more.

Cable joints should be saved wherever possible to reduce construction and maintenance costs.

OVER

**A new method of rodding, using a duct motor, will soon be introduced for many types of duct routes.*

The cost of making a medium-sized joint, involving the jointing of 1,000 pairs, wire-for-wire, plus the fitting of an outer water-seal, is considerable, while additional maintenance costs are introduced if the joint later fails for any reason. With careful planning of the layout of the lightweight cable lengths, as many as 10 joints can be saved in every mile compared with lead-sheathed cables.

Of several methods available for sending messages continuously over a long distance, a simple telephone system is one of the cheapest, but tests carried out during the laying of experimental lightweight cables showed that this system was not always practicable. A telephone line cannot always be laid over-ground in a built-up area and it is not always convenient to draw it into a separate duct route, although occasionally a line may exist for some other purpose. Nor is it economic to open an existing cable route to provide a line because of the high cost and the extra jointing staff needed to do this.

Other communication methods include the use of earth current telephone circuits and induction systems over the cable and rope, but the modern radio link has so far proved to be the cheapest, most reliable and most versatile system. To give a consistent operating range of 800 yards at street level in built-up areas, on a frequency of 170 Mc/s, the transmitter output power must be about 0.5 watt and the receiver sensitivity about 1 microvolt. This takes account of the difficult working conditions that often occur—interference from nearby traffic and machinery, obstructions and buildings—although frequency-modulation is used to help reduce these effects. In open country where there are fewer obstructions to the radio signal, transceivers with this performance have an operating range of two to three miles, which

Waiting at the winch for a call over the transceiver to begin cabling. The transceiver shown here is the No. 1A, the first portable set to be used by non-radio Post Office staff on external work.

While one man sends instructions to the winch, the last loop of a polythene cable is eased into a manhole. This cable will provide telephone service for 2,000 subscribers.

is more than adequate for cabling work.

The first version of the new portable transceivers issued to cabling gangs was the Transceiver No. 1A, based on the Type FM 113, manufactured by Messrs. Hudson Electronic Devices Ltd., of Sydenham. It contained transistors in the receiver for low battery consumption and valves in the transmitter for high output power. This was the first portable set to be used by non-radio Post Office staff on external work and helped to give impetus to the introduction of the long-length cabling methods.

The latest version—the Transceiver No. 1B—is based on the *Bantam* and the *Linesman* both manufactured by Messrs. Pye Telecommunications Ltd., of Cambridge, and is the first all-transistor radio set to be used by the Post Office. Its small size, light weight and low battery consumption make it ideal not only for other aspects of cabling work, such as duct-rodding and aerial-cabling, but also for other external work such as cable-fault locating and radio interference investigations. Transceivers will be used in increasing numbers wherever a portable two-way communication system is required between mobile parties and will produce further savings in both time and effort.

THE AUTHOR

MR. D. E. KENNARD, AMIEE, Grad.IERE, is an Executive Engineer, External Plant and Protection Branch. He joined the Post Office in 1945, as a Youth-in-Training, Exeter Area, and later worked in CTS Stone, as a demonstrator. In 1954, he was promoted Assistant Engineer to Equipment Branch where he remained until 1959.

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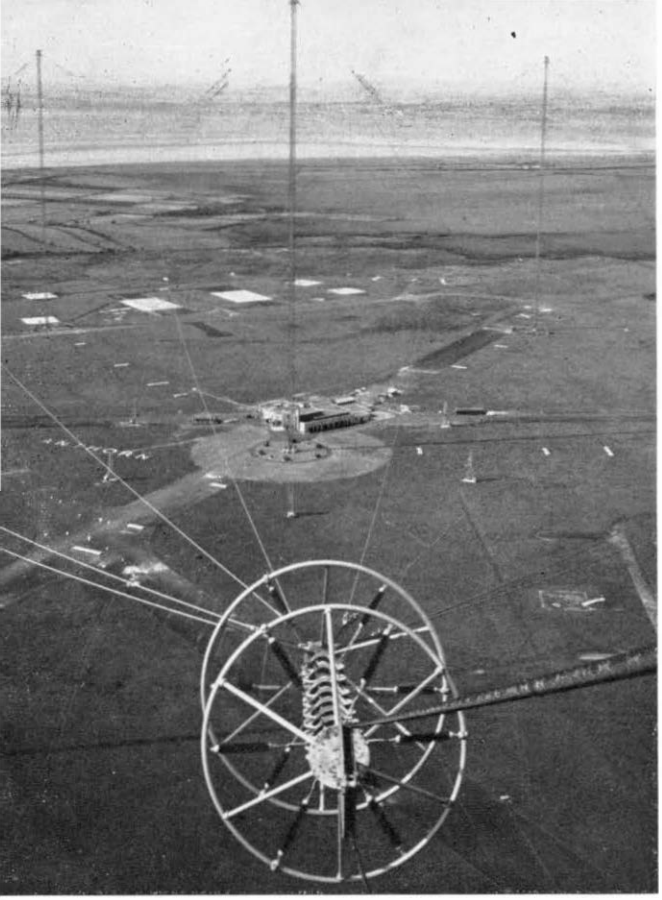
NEW POLICE COMMUNICATIONS CENTRE

When the Headquarters of the Metropolitan Police moves from New Scotland Yard to Broadway, Westminister in 1966 it will be equipped with an 1,800-extension telephone exchange and a 150-line automatic teleprinter exchange.

This new communications centre will provide vital links between Headquarters, divisional police stations and fire and ambulance services. The teleprinter exchange will enable messages to be sent simultaneously to any number of stations direct from the new headquarters. The equipment, ordered from Standard Telephones and Cables Ltd, will cost more than £200,000.



The centre mast and transmitter building seen from the top of one of the 618 ft high masts.

On the site of a former wartime RAF fighter station now stands Europe's biggest and most powerful radio station, built to Post Office specifications and staffed and maintained by the Post Office. It cost nearly £4 million to build and equip.

NATO's NEW RADIO STATION

BETWEEN the Cumberland villages of Anthorn and Cardurnock, on the Solway Firth, a giant spider's web spreads over 400 acres at skyscraper level. This futuristic cobweb is the aerial system of Europe's new and largest high power, very low frequency radio telegraph station, provided, staffed and maintained by the British Post Office as a communications station for the North Atlantic Treaty Organisation.

High power and very low frequency give the most reliable and dependable radio communication and NATO stations such as Anthorn can provide instantaneous service to any part of the world. The site which the Anthorn radio station occupies was a World War Two fighter aerodrome and is particularly suitable for a VLF station.

Anthorn's vast aerial system consists of six rhombic-shaped sections arranged in a radial formation, suspended from 13 masts 617-748 ft high, and covering almost the whole site. Each section of aerial can be lowered to the ground for maintenance without fouling mast stays or other obstructions.

The aerials consist of steel-cored aluminium conductors about 1 in. in diameter. The masts supporting them are made of galvanised steel. They are triangular in section and stayed in three directions at intervals of 150 ft.

Beneath the gigantic aerial system is the transmitter building which accommodates the transmitter staff, the aerial tuning inductors and emergency power plant. Most of the station's equipment is push-button operated at a central console. All transformers and regulators associated with the transmitter are located under a protective enclosure at the side of the building.

The building is extensively screened against electrical losses by a mesh of copper wire—75 miles long—ploughed a foot below the entire site. The fixed variable inductors tune the aerial

system over the frequency range 16-20 kc/s and an automatically-controlled variometer compensates for variations in aerial capacitance due to weather effects, ensuring that the aerial system is always tuned.

The transmitter itself comprises a 250 mW stage followed by five stages of amplification. At its normal working frequency of 19 kc/s it can deliver a power of 550 kW to the aerial. The radio-frequency valves are air cooled and mercury-vapour HV rectifier valves have overload protection equipment which can remove power from the transmitter in about five millionths of a second.

Reliability is the prime consideration in the Anthorn installation. The transmitter, for example, has duplicate equipment which automatically comes into operation if there is a valve or equipment failure. Two 775 kvA reserve emergency generators can each independently supply one half of the transmitter.

The Anthorn Station, which was built to British Post Office specifications, took three years to complete and cost £3,777,364. The provision of the station was subject to international competition by all member countries of NATO. As technical adviser and agent of the Ministry of Defence, the British Post Office (with assistance from the Ministry of Public Building and Works on building) translated the operational requirements into technical specifications, determined the site, negotiated the contract and supervised the work.

Above: The six halyard winches around the base of the centre mast. Below: Lady Mumford, wife of Sir Albert Mumford, then Engineer-in-Chief of the Post Office, presses a switch to send out Anthorn's first message to the NATO forces.

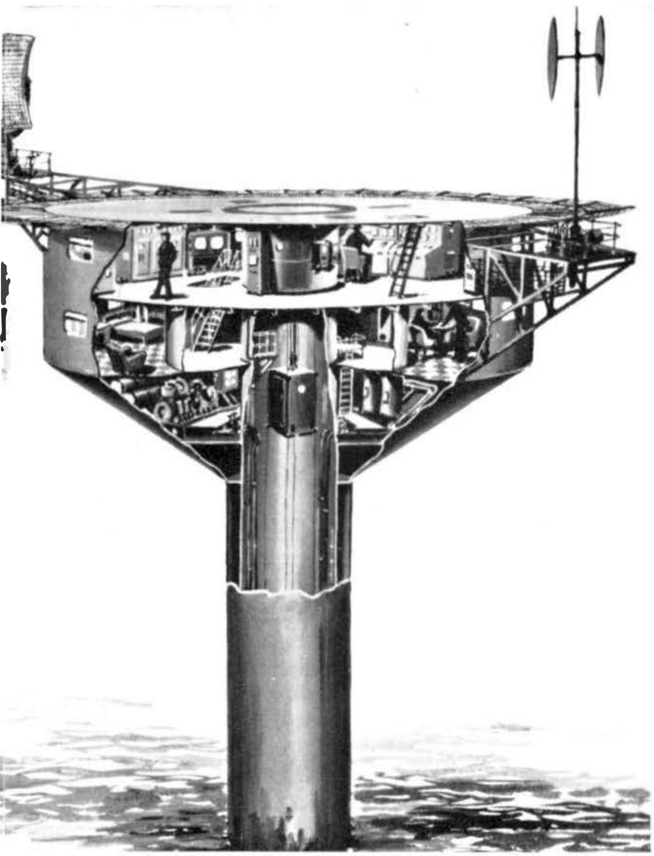
A scale model of one of the floating radio stations showing the aerials and, in the centre, a helicopter landing platform. The station would be about 400 feet long, most of it submerged

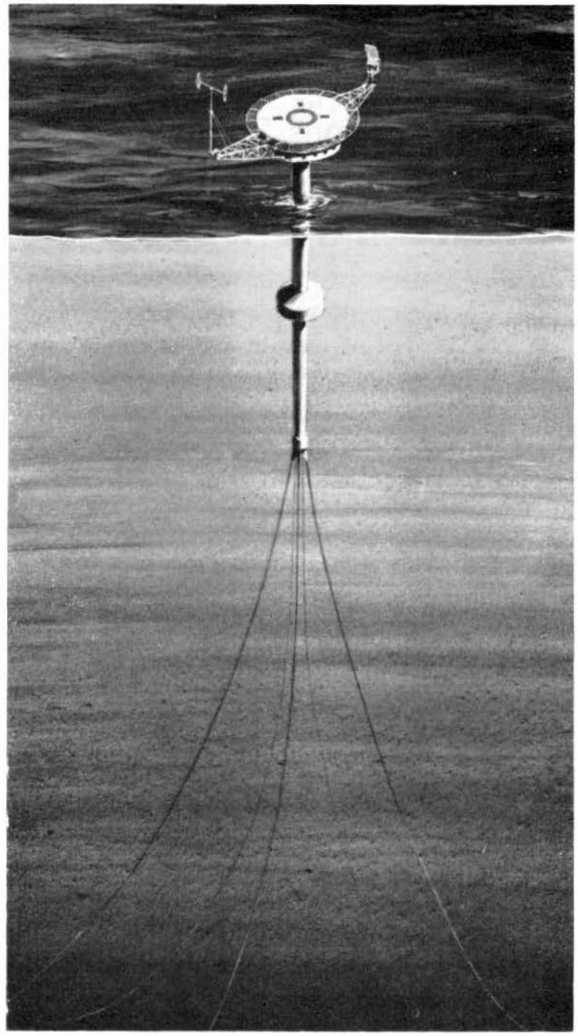
A CHAIN OF FLOATING RADIO

PLANS are being made to set up a trans-Atlantic network of floating radio stations which linked by submarine cable, would provide high-quality communications for the ever-increasing number of aircraft which cross between Europe and North America every day.

The scheme, on which a design study has already been started by Seastation Telecommunications (a company especially formed for the purpose), in association with the Ministry of Aviation, would involve building up to four sea stations. Each station, manned by about 12 men, would be able to provide vital radio communication and at the same time act as a navigational beacon and supply radar information to air traffic control centres on both sides of the Atlantic. The cost of the project, which would take up to three years to complete, would be between £10-£15 million.

At present, an aircraft crossing the Atlantic is out of range of first-class communications services. It cannot be contacted and it cannot contact its land bases with any reliable degree of certainty to ensure satisfactory control of air traffic. A chain of sea stations, linked by submarine cable and equipped





bove: An artist's drawing showing how the crew's uarters and equipment would be arranged. Right: he stations would be anchored to the sea bed.

STATIONS?

with radio apparatus, would ensure reliable communications at all times, says Seastation Telecommunications.

The main communication services provided by a sea station would be radio in the VHF and UHF wavebands for air traffic control, for airline company traffic and for passenger-to-shore conversations. A number of navigational services for aircraft and primary and secondary radar facilities would also be provided. The sea stations could thus also be used for weather reporting and forecasting.

Each sea station in the link would be a tubular structure about 400 ft long and 16 ft in diameter, floating vertically in the sea with the greater part of its length immersed. The top end of the cylinder would support a superstructure, towering well above the waves in the worst of storms, which would accommodate the equipment, aerial systems and manning-crew and provide a landing deck for helicopters. The bottom end of the cylinder would be moored to the seabed by three anchorages. Scale model tests indicate that even in extreme conditions the sea station would rise vertically no more than six inches and pitch by no more than half a degree.

Thanks to the research engineers at Dollis Hill, new apparatus has been developed which makes it possible for telephone calls to be made over long-distance high frequency radio circuits during even the most adverse conditions. This article describes how the new equipment works

TAKING THE NOISE OUT OF RADIO CIRCUITS

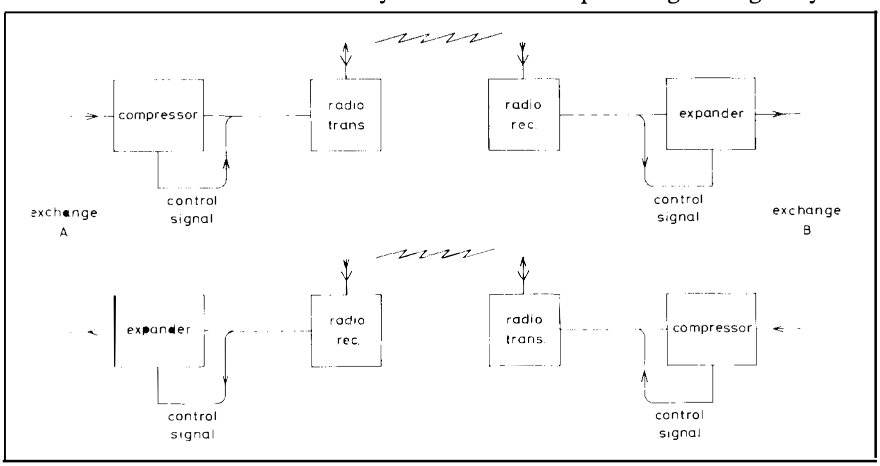
By L. K. WHEELER, BSc(Eng), AMIEE

A NEW type of terminal equipment for use on long-distance high frequency radio telephone circuits, recently developed at the Post Office Engineering Research Station, has successfully undergone a four months' field trial on a London to New Delhi circuit.

The new apparatus reduces the effects of noise and other kinds of interference on the transmission, and increases the stability of the circuit which, in turn, provides other benefits conducing to greater ease of communication between the telephone users.

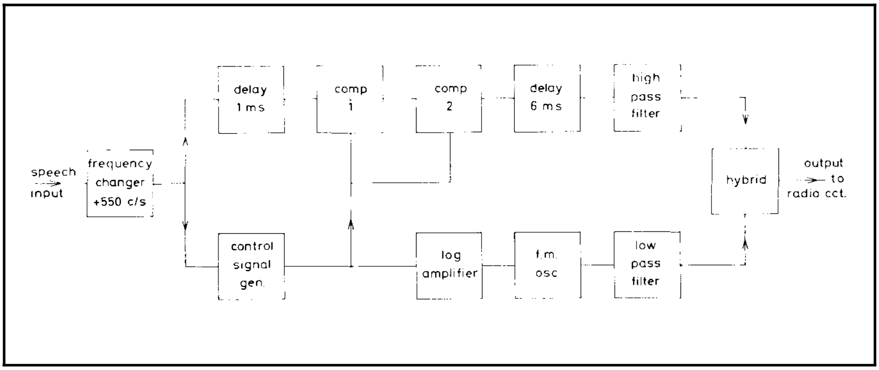
Under the new system the outgoing speech is passed between the International Exchange and the radio transmitter through a "compressor" (an amplifier), the gain of which varies automatically according to the level of the input, so that the output is substantially constant whether the talker is quiet or loud and whether the line loss is great or small. The automatic gain adjustment is fast-acting so that even the syllable-to-syllable variations of level are smoothed out. This enables the radio transmitter to be efficiently used all the time and in particular to radiate a strong signal even when the level of the original speech is low. Consequently, the best possible signal-to-noise ratio is always achieved and not just during loud passages. The variation in the gain of the compressor is effected by a control current derived from the speech signal itself and a corresponding control signal is sent through the same radio transmitter as the compressed speech but by a separate narrow channel using frequency modulation to make it relatively immune to the effects of fading.

Between the radio receiver and the distant exchange the received compressed speech is passed through an expander which performs the inverse operation to that of the compressor so that the original syllabic variations in level are restored. To do this, a control current similar to that produced in the compressor must be provided. This, of course, is received as the frequency modulated control signal which is filtered out from the composite signal originally transmitted. To ensure that



This diagram shows in a simplified form a radio-telephone circuit using the Lincompex system.

A more detailed outline of the send equipment used in the Lincompex system.



the expansion is correct, the compressed speech must itself be of constant level, so, although much of the level variations due to fading are removed by the radio receiver automatic gain control, to smooth out residual variations before the expander, the speech signal is passed through a 'constant volume amplifier', which has a time-constant considerably longer than the syllabic period.

The essential elements of the scheme may be summarised as an infinite compressor at the sending end and an expander at the receiving end, the complementary action of which is effected by a linking control channel—hence, LINCOMPEX—LINked COMPressor and EXpander. The system achieves a constant relationship between the levels at the input of the compressor and the output of the expander and so provides a circuit of constant loss, similar to a line circuit. Also, for any given conditions of fading and noise, the signal-to-noise ratio is independent of the actual speech level. During quiet passages of speech, when noise would ordinarily be most noticeable, the noise is correspondingly depressed and in the silent intervals the expander inserts so large a loss that the noise becomes inaudible.

The speech input has a frequency-range confined between 250 c/s and 3,000 c/s normally, which is raised by 550 c/s by means of a frequency changer to leave the range 250 c/s to 800 c/s free for the subsequent insertion of the control channel. Since the output is later restricted to an upper frequency of 3,000 c/s before acceptance by the radio transmitter, speech frequencies above 2,450 c/s will not be transmitted. The location of the control channel at the lower end of the frequency range is not essential in the Lincompex system but was dictated in the experimental equipment by the characteristics of certain readily available units of apparatus. The frequency range made available is greater than that used by the control channel but would make it possible to use a certain type of privacy (or scrambling) equipment in the circuit.

After the frequency shifter, the circuit divides, one branch leading to the control signal generator which is a 2:1 compressor (that is, a change of $2x$ db in the level of the input signal is reduced to a change of x db at the output). The control signal is provided by the rectified and smoothed output. The other branch of the circuit is through a one-millisecond delay network to two 2:1 compressors in tandem, but the variable loss networks of these are actuated by the control signal derived in the other branch and not by their own outputs. This results in the output from the second compressor being sensibly uniform in amplitude, since the time-constant of the control current of about four milliseconds permits the gain to be varied at the syllabic rate of the speech. The delay network and the independently derived control signal enable the peaks of input speech to be anticipated so that the gain is already partially reduced when they arrive.

The control signal also modulates the frequency of an oscillator so that its output changes by two c/s for a change of one db in the level of the speech input. This relationship is obtained by the use of a logarithmic amplifier before the frequency modulator. The maximum frequency change is from 520 c/s to 420 c/s to cater for a range of 50db, but under dynamic conditions the spectrum will include modulation components outside this range and a band of 250-300 c/s is necessary for the speed of response.

Filters are connected in the speech and control paths to prevent mutual interference and the two signals are combined by a hybrid for transmission

OVER

TAKING THE NOISE OUT . . . . *(Contd.)*

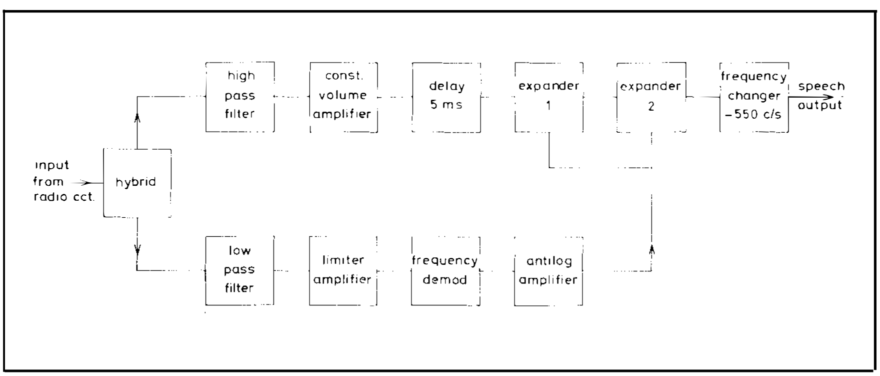
over the radio telephone circuit. Because the control channel is restricted to a relatively narrow frequency band by filters, the control signal suffers appreciable delay relative to the speech signal and compensation must be provided by inserting a delay network in the speech path.

The output from the radio telephone circuit is divided into the speech and control signals by corresponding filters. The control signal is amplified, limited to constant amplitude and demodulated by a frequency-discriminator and the control current is recovered via an anti-logarithmic amplifier. The speech signal passes through a "constant volume amplifier" to get rid of the residual fading which may remain after the action of the automatic gain control of the radio receiver which is relatively slow in action. Now the speech signal has been restored practically to a constant level, still compressed as it left the send terminal. It is delayed by five milliseconds to complete the compensation for the higher propagation time of the control channel and passed to the expanders which amplify according to the magnitude of the control current so that their action is complementary to that of the compressors at the sending end and the syllabic variations in speech amplitude are restored. The speech is finally shifted in frequency back to its original position in the frequency spectrum.

In the conventional terminal equipment of high frequency radio telephone circuits, a constant volume amplifier is usually provided at the sending end but an expander is seldom used at the receiving end and, without the control channel used in Lincompex it is not possible to make this complementary to the compressor. Hence the syllabic amplitude characteristics of the speech must be preserved by making the constant volume amplifier relatively slow in self-adjustment. Consequently, although the peaks in speech amplitude are raised to a predetermined level, the peak to mean ratio is similar to that in the original speech and the lower amplitude passages are not amplified so much as in Lincompex to combat the noise encountered in transmission.

The absence of an efficient expander at the receive end means that the noise will not be suppressed during the silent intervals or low level passages of speech. There is no fixed relationship between the signal levels at the two ends of the circuit and so if the channel is lined-up to have small loss for high input levels then, due to the constant volume amplifiers, it will have a considerable gain for low input levels. Therefore, when it is connected with a similar channel working in the opposite direction via two wire/four wire terminations to form a complete telephone circuit, it may not be stable and could oscillate or "sing". To prevent this, "singing suppressors" have to be inserted at each end of the circuit. These are voice-operated switches which permit only one direction of the circuit to be completely connected through at any one time. The action of the talker completes the send path and breaks the receive path, but the operation of the device is differential, so this can be done only if a strong signal is not already being received. Because the singing suppressor does not discriminate between noise and speech it is possible under conditions of severe noise for the talker to suffer complete "lock-out", being unable to override the incoming noise.

With Lincompex, because the circuit can be set to produce a slight, constant loss, singing suppressors can be eliminated. As on other long distance circuits, echo suppressors may be required and despite some considerable differences from singing



This diagram shows how the receive equipment of the Lincompex system operates.

suppressors they can, in principle, produce lock-out, but the muting effect of Lincompex prevents this trouble from occurring. The resultant effect is a great relief of users from the frustration produced when much repetition is entailed by lock-out.

Briefly, the main advantages of Lincompex are: constant circuit loss eliminating need for singing suppressors, improved transmitter loading producing higher average signal to noise ratio and muting of noise which eliminates lock-out and gives a quieter background to conversation.

The chink in the armour of Lincompex may occur in the control channel. If noise is of such a high level as to affect it, a noticeable distortion or roughness in the speech is produced. With the random noise resulting from natural sources this stage is reached only when a conventional system would be regarded as unfit for commercial use. However, an interfering transmission concentrated in the same frequency range, for example, a telegraph transmission, could paralyse Lincompex while leaving a conventional circuit still tolerable.

The other disadvantage, which in practice appears to be not very great, is that with a fixed bandwidth allocated to a circuit, the frequency range of the speech must be reduced to provide space for the insertion of the control channel.

After the installation of the apparatus at London and New Delhi, many test calls were made during which it was possible to switch from Lincompex to conventional equipment. The prevailing conditions were often such as to produce lock-out due to false operation of singing suppressors in the normal terminal, but it was possible to converse with ease through Lincompex, the background noise being completely suppressed. In good conditions, the effect of the more restricted frequency range imposed by Lincompex was detectable, but the greater reliability of communication masked the difference when conditions were adverse.

The circuit was handed over for normal traffic use at the beginning of December, 1964, and continued in service until the beginning of April, 1965. The performance was very satisfactory and the traffic carried comprised many calls extending beyond the terminal points of the circuit—to Continental Europe and also to the United States. It was found that a significant increase in usable circuit time was obtained.

THE AUTHOR

MR. L. K. WHEELER *is an Assistant Staff Engineer at the Post Office Engineering Research Station. He entered the Post Office as a Probationary Inspector in 1933 and was appointed Executive Engineer in 1937. Since then, in successive grades, he has been mainly concerned with the developments and investigations in various aspects of telegraph transmission over line and radio.*

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THE WORLD'S TELEPHONES

On 1 January, 1964, there were 171 million telephones in use throughout the world—an increase of 9.9 million (or 6.1 per cent) compared with 1 January, 1963. The numerical increase was the highest so far recorded.

The country with most telephones was the United States (84.4 million), followed by Japan (10.6 million) and the United Kingdom (9.3 million). The United States also headed the list of telephones per 100 of the population with a figure of 44.26, followed by Sweden (42.25) and New Zealand (35). The number of telephones per 100 of the population in the United Kingdom was 17.41.

According to the American Telephone and Telegraph Company which produces these statistics, the most telephone-minded people in the world are the Canadians who, during 1963 had 11,313 million telephone conversations—an average of 597.7 per person, followed by Iceland (574.9 conversations per person), and the United States (570). The total number of telephone conversations made in the United Kingdom was 5,778.8 million an average of 107.9 per person). At the bottom of the list was Mali (3.1 million conversations and an average per person of 0.7).

The City and County of London easily headed the United Kingdom table of principal cities with most telephones per 100 of the population, totalling 44.3. Second was Greater London (31.9), third Oxford (27.8), fourth Cambridge (27.1), fifth Edinburgh (23.4) and sixth Norwich (21.7).

●

A New Cable In The Baltic

A new submarine cable which will provide 480 telephone circuits, is to be laid in the Baltic Sea between Nykobing (Falster) and Ronne, on the island of Bornholm. The contract for supplying and laying this 105 nautical miles of coaxial cable and 13 transistorised submerged repeaters is worth nearly £500,000 and has been placed with Submarine Cables Ltd.

THE FIRST DATEL 600 SERVICE

By J. J. ADLER

A new data transmission link carried over the public telephone network—the Datel 600 Service—has been brought into service by a steel company between Sheffield and Barrow. One of the new system's first tasks is handling pay slips for 1,000 steel workers

At the Sheffield end of the new data transmission link. Left to right: A paper tape punch, control console, Post Office Datel 600 equipment (below the telephone), and a STC receiving unit. The data from Barrow is processed by computer and the resultant information is returned to Barrow by post.

THE first installation under the Post Office's recently introduced Datel 600 "data-by-phone" service went into action on 22 March to provide a link between a new ICT 1300 computer at the United Steel Company's headquarters in Sheffield and its steelworks at Barrow.

The new ICT 1300 brings the total number of computers employed by the United Steel group to a dozen. Most of the larger companies within the group use analogue and digital computers for process control, payroll and other accounting applications and scientific research, but the Barrow steelworks, with a work force of around 1,000 is not considered large enough to justify the expense of its own computer. The Barrow works will, therefore, be given access by way of the Datel 600 link to the new ICT 1300 which will also take over group purchase and sales statistics and shares registration previously handled by a five-year-old ICT 1202 computer. This pooling of tasks will ensure that the new computer will be

fully utilised and that the Barrow works will for the first time enjoy access to a modern computer.

The mechanics of the 120-mile data transmission link between Barrow and Sheffield are that data is punched onto paper tape at Barrow and fed into a Standard Telephone and Cables Ltd. digital terminal equipment. The signals this generates are translated into a form suitable for transmission over the ordinary public telephone network by a Post Office Datel Modem 1A. At the Sheffield end another Modem demodulates the signals into their original form and feeds them into an STC reception terminal which produces tapes for feeding into the ICT 1300 computer. A special error control system, developed by STC, is expected to reduce the rate of undetected errors due to line disturbances to fewer than one character in ten million transmitted, or approximately one error a year at United Steel's current volume of transmissions. Even this one error should be picked up by data validity checks built into the computer programmes.

United Steel had the choice between using the new Datel 600 service or the teleprinter-based form of the Datel 100 service. They chose Datel 600 not only because it allows for the more sophisticated kind of error control they wanted but also because it offers transmission speeds which can be anything from 12 to 24 times faster, depending on the transmission mode used. Although transmissions from Barrow will initially total only 50 minutes weekly (approximately two million binary digits) most of them will be concentrated in a Monday morning peak period. The reason for this is that one of the ICT 1300's first tasks is payroll accounting for the Barrow steelworks. Wages are calculated on a rate for each job multiplied by hours worked with any bonuses due added. This variable data is collected up till the end of the Saturday morning shift and transmitted to Sheffield on Monday morning.

At Sheffield the data is fed into the computer which prints out pay slips for every Barrow employee, ready for posting on Tuesday morning (although Datel 600 can provide two-way transmission, a one-way link was chosen in this instance for greater economy). All employees at Barrow are now able to check their pay slips 24 hours before actual pay day on Thursday or Friday, leaving a practical interval to clear up any queries.

During the next stage of the programme, the ICT 1300 will take over stock control and financial accounting for the Barrow steelworks. The stock to be controlled is divided between consumable stores and engineering spares and so on and processed stocks—billets used in the manufacture of cotton baling ties which the firm exports to Texas and California, jute baling hoops for Pakistan as well as fencing bars and spring steel for a variety of markets.

The purpose of the computer control will be to effect "expendential smoothing", that is, to strike a balance between the necessity of ordering stock in time to prevent production shutdowns and the desire to keep the overall level of stocks to the minimum.

Each type of material will be allocated a "bin number" and each bin will be given a priority rating depending on the average rate of stock movement. Store requisitions will be fed into the computer which will periodically scan "bin numbers" according to their priority rating, issue purchasing orders complete with quantities and the name of the supplier and also instructions to storekeepers to check certain bins. Physical checks carried out by the storekeepers will be accepted as correct and fed into the computer to up-date information.

The advantage of the new computer system will be that, unlike the old, it will concern itself not only with maximum and minimum stock levels but also with delivery times, the most economic ordering quantities and the spotting of trends in stock movements. Through being released from routine decisions on the issue of purchase orders, buyers will be able to devote more time to market intelligence, seeking out the most economical sources of supply and the best delivery times. Buyers' forecasts on what they expect to pay for supplies over the next 12 months will also be given to the computer which will then be able to spot any untoward price movements.

As well as taking over from the previous ICT 1202, the new computer will also tackle payroll, order scheduling and costing calculations for United Steel's steel reinforcement subsidiary McCall & Co. of Templeborough.

Included in the headquarters computing staff of seven systems analysts and six programmers are graduates on United Steel's management trainees' course who have opted to specialise in computer applications after their first 18 months of general induction. On completing their training, these young managers will be seconded to other branches of the group to assist in the development of computer departments.

In this second article in the series telling how the Post Office is improving the efficiency and productivity of the telephone service, the author describes Work Study and how it is being applied in the Engineering Department. Work Study is also, of course, applied in other Post Office Departments

HOW WORK STUDY WORKS

By E. CROFT, AMIEE

WORK STUDY is the study of work in its widest sense, although most people associate it with factories and conveyor belts rather than with service industries such as the Post Office.

The Post Office first used Work Study in its Factories Department where it has for many years been applied to such work as the repair of telephone apparatus. Subsequently a few people from the Engineering Department were sent to Cranfield College to be trained in the techniques of Work Study and on their return were given the task of seeing how these techniques could be applied to engineering work in telephone areas.

The results of these early efforts were so promising that the use of Work Study has since expanded steadily and, following the recent setting up of the new Management Services Group in the Engineering Department, it is expanding even more rapidly.

This early work confirmed that the Work Study approach has universal application in the Post Office not only in factories but also to such work as cabling, jointing, telephone installation, offices, stores, transport, controls—anywhere, in fact, where work is done.

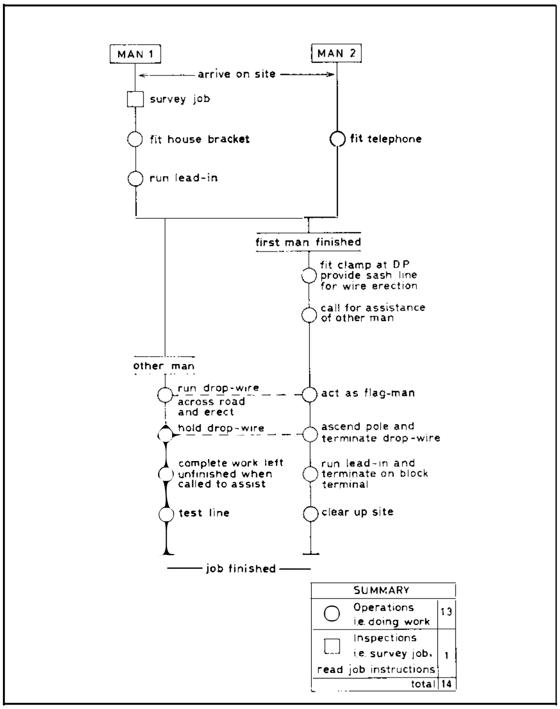
Much of Work Study seems, at first sight, little more than common sense. But regrettably common sense is not all that commonly applied and in practice most of us tend to be guided by traditional ways of doing things rather than by a fresh look at the problem.

The great contribution which Work Study can make to increasing productivity lies in the fact that it subjects both established methods and proposed changes to a critical and analytical examination. The work study practitioner refuses to be blinkered by tradition or dazzled by the sudden brainwave (whether his own or someone else's). At every stage when considering an operation he is asking such questions as "What exactly is being done?", "What else could be done?", "When should it be done?", "Who should do it?", "Why should it be done this way?" and, above all, WHY DO WE DO IT AT ALL? Under this sort of attack many existing practices begin to crumble and new ideas may not survive the test.

Work Study falls roughly into two parts—Method Study and Work Measurement. Method Study is concerned with the development of easier, simpler and more productive methods, while Work Measurement is used to assess how long the job takes or should take. In practice, the two are inseparable, because the only final proof that a new method is more productive is that the job takes less time and effort. Not only that, but generally one cannot start to improve an existing method effectively without first measuring, however roughly, how much time and effort are being expended upon each part of it.

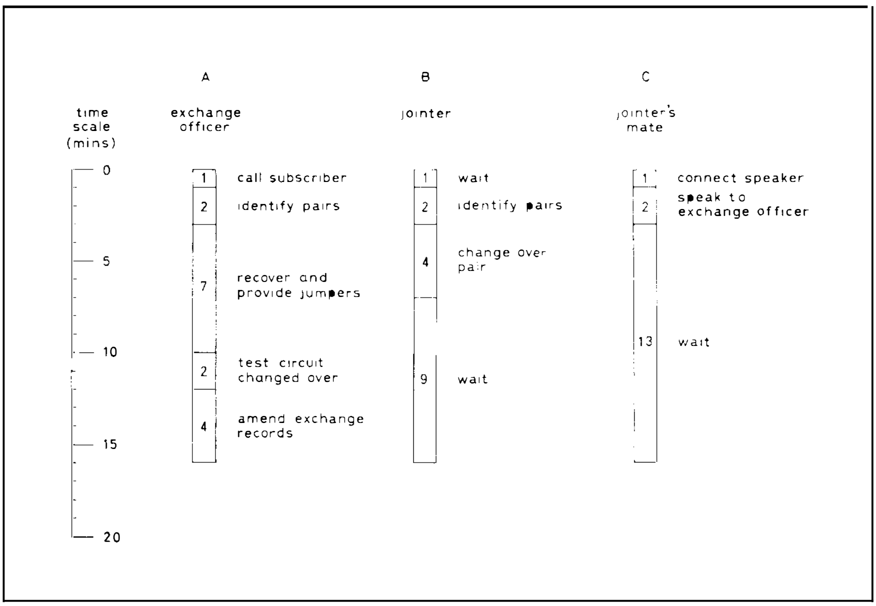
The first step in applying the Work Study approach is to select the problem to be studied. This may seem self-evident, but people often devote their time to solving the wrong problems because the really important problems in a work situation are not always readily apparent. The commonest failing is the tendency to devote too much attention to the exceptional cases which arouse interest because they are unusual and to ignore the great bulk of run-of-the-mill work which is where quite often the biggest savings can be made. Generally it pays to concentrate on those fields of work which use large amounts of labour, because potentially they offer the greatest scope for savings. Other factors, such as improving the provision and maintenance of customers' services, are also important.

OVER



This process chart shows how a two-man party should carry out a customer's installation involving wire across a road.

This multiple activity chart shows a method commonly used to divert cable pairs between a cabinet and the exchange. Each man's activities have been recorded against a time scale.



It is not surprising, therefore, that most of the efforts of the Engineering Department have to date, been in the fields of installation, construction and maintenance where large amounts of manpower are used and the work impinges directly on service to the customer.

Work problems can usually be studied more effectively if one starts by recording the existing method on paper. This record can then be studied in detail away from the actual job. Work Study techniques provide a variety of ways of doing this. The two most generally useful in studying the work done in Telephone Areas are activity charts and process charts. Activity charts are a record showing against a time scale the activities involved in doing a job, while process charts show the sequence of operations.

Activity charts are used to build up an accurate picture of how the job is done. They can also be analysed to show what proportion of time goes on each activity, for example, drawing stores, travelling, working and so on. Nowadays, machines often take over the hard work and an activity chart showing how an expensive machine is employed can be of just as much interest as that for a group of men.

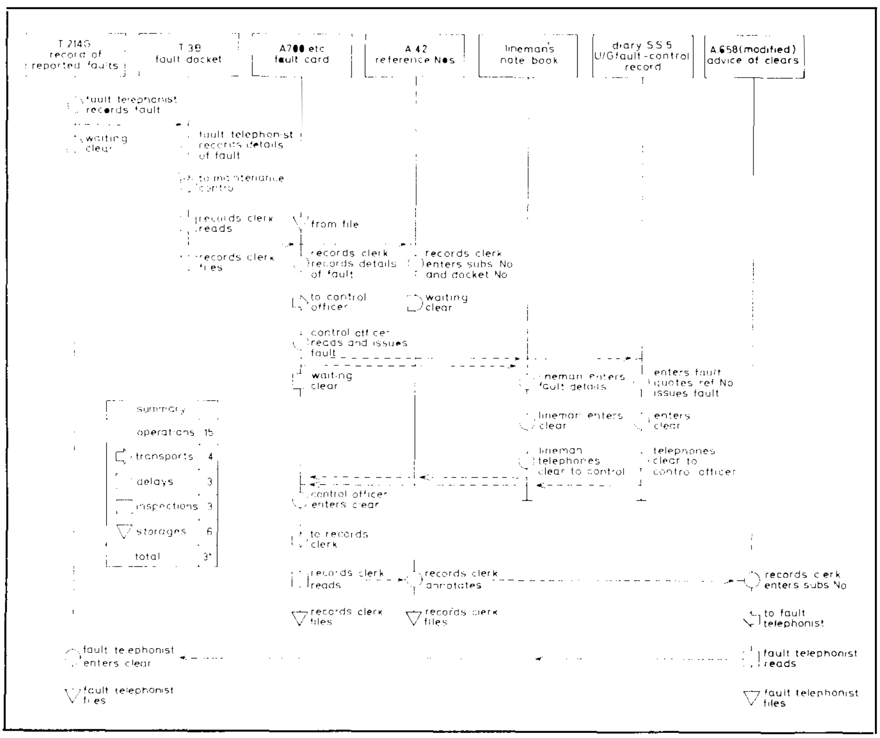
Process charts show the sequence of events carried out to complete a job and may relate to either men or machines or both. They can also be used to show what happens to a material as it goes through some process.

It may be thought that a Telephone Area does not process material, but papers and forms are material and much of the work of a Telephone Area is done on them. A process chart showing what happens to the forms used in a procedure not only gives a very good picture of that procedure, but it can also be used to form an assessment of its complexity by counting up all the operations, inspections, transports and so on.

A chart of the present standard Advice Note procedure, for example, shows that a typical 10-copy Advice Note can involve 343 operations, 151 transports, 95 storages, 46 inspections and 15 delays—a ripe field for Work Study and one which has received and is continuing to receive attention. A simplified procedure has been developed and should be on trial by the time this article appears.

Work Study will often show that individually men can do comparatively little to increase their

Example of a Process Chart showing the procedure for dealing with subscribers' complaints in a non-Eng. area.



productivity. To achieve any real improvement requires action at a higher level. A glance at the activity chart, for example, shows that the jointer's rate of working is governed by the operations which have to be done in the exchange. It also shows that during this operation the jointer's mate is not very effectively employed.

The employment of jointers' mates has been taken up as a general question and a recent agreement with the Post Office Engineering Union provides that construction and maintenance jointers will, in future, work individually except where a second man is necessary for safety reasons. Applying critical examination to the particular job (illustrated by the activity chart) leads inevitably to the conclusion that the organisation should be changed so that the jointer can work independently of the exchange. This can usually be done by running the jumpers in advance. Carrying critical examination to its logical conclusion, Planning Engineers might like to ask themselves "Why do we do these diversions?" and "Are they all really necessary?"

Many other practices which have been in common use for many years do not stand up to critical examination. For example, at present if a customer ceases his line and there is no indication of a take-over by an incoming tenant, a cease Advice Note is issued and the instrument is recovered. In a high proportion of these cases the incoming tenant subsequently orders the telephone. Recovering a telephone and providing one again in the same house is obviously wasted work—particularly so with shared service lines where de-sharing and re-sharing can be especially time-consuming. The obvious solution is not to recover the telephone in these cases and to concentrate efforts on trying to sell it to the incoming tenant. If successful this is much more productive than recovering lines and later restoring them. This change has been incorporated in the recently introduced Stop-Start Advice Note procedure.

Not all changes can be as sweeping as this but it is a good example of the fact that the best way to increase the productivity of a particular operation is not to do it at all.

There is no magic in Work Study. It provides a disciplined method of approach to finding, recording and critically examining the facts about how work is done. In the process it seeks to lay bare everything about the present method and the possible alternatives, and out of this to find a better way of doing the job.

This shows the standard Symbols used on Process Charts

○	OPERATION	Indicates the main steps in a process, method or procedure.
⇨	TRANSPORT	Indicates movement of men, material, equipment or papers
□	INSPECTION	Indicates that something is examined or verified, e.g., reading job instructions.
D	DELAY	Indicates delay other than permanent storage.
▽	STORAGE	Indicates permanent or semi-permanent storage, e.g., stores in Section Stock, papers in a file.

As a modern and fast expanding industry the Post Office cannot afford to ignore its lessons and all have a part to play in seeing that when new and better methods of working are developed they are quickly put into effect and that there is no subsequent drifting back into the old and less efficient ways.

THE AUTHOR

MR. E. CROFT *is an Assistant Staff Engineer in OWS Branch of the Engineering Department where he is in charge of a section engaged on Work Study. Before his appointment to the Engineering Department he was an Area Engineer in LTR.*

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British Orders for SEACOM

Nearly 200 undersea repeaters and equalisers, 1,800 miles of submarine cable and large quantities of shore-based power-feeding equipment have been ordered from Britain at a cost of nearly £6 million for the second stage of the SEACOM, the South East Asia Commonwealth telephone cable.

The cable will link Hong Kong with Australia by way of Guam and Madang (New Guinea). At Guam it will be connected to the United States-Japan submarine cable which was opened in 1964.

These latest orders, which have been placed with Standard Telephones and Cables Ltd, bring the total amount of orders received by the company for the Commonwealth Cable Scheme to more than £22 million.

This article tells how British commercial resins are being used by the Post Office to make air blocks in polythene sheathed cables. This new method of inserting air-tight seals has resulted in . . . .

BETTER and CHEAPER AIR BLOCKS

By H. E. ROBINSON

A MORE effective, less costly and quicker method has been devised by the Post Office for inserting air-tight seals in underground cables which are pressurised to prevent moisture entering them and putting the circuits out of action if the sheath is damaged.

The new system, which involves the use of new British commercial resins which are easy and safe to handle, is already being employed to make air blocks in polythene sheathed cables and arrangements are now being made for it to be used in lead-covered cables.

To keep the air where it is wanted and to ensure that it is effective over the greatest possible length of cable, air-tight seals are made in pressurised cables at exchange cable chambers, and at street cabinets and pillars. In lead-covered, paper-insulated cables this presents no problems since the seals can be made by injecting molten wax. But this method cannot be used for polythene cables because the wax has to be heated to over 300 degrees Fahrenheit and at this temperature polythene, with which the wax would come into contact, melts.

To overcome this difficulty, the Post Office has, until now, been using synthetic resins of American origin for making air blocks. These resins, however, suffer from a number of disadvantages. Sometimes the resin block becomes separated in service from the cable sheath during changes of temperature because the resin expands and contracts at a different rate from the polythene; moreover, special equipment has to be used for the resin. The new resins and techniques injecting have overcome these defects.

An air block in a polythene-sheathed cable is made by removing a section of cable sheath and bonding bands of polythene-coated aluminium foil to the two butts of the sheath. The foil is bound with copper wire which is gently heated so that the polythene coating on the foil unites with the sheath. The copper wire is then removed, leaving the foil strongly bonded to the sheath (this process can also be applied to PVC-sheathed cable if a PVC-coated foil is used).

A polythene sleeve is then fitted over the section of cable to contain the air block and one or both ends are sealed. The sealing is done either by polythene injection welding or epoxy resin putty wiping techniques, or by building up the sheath with rubber tape to the internal diameter of the sleeve and securing the sleeve with jubilee clips. The sleeve is then filled with the synthetic resin which envelopes the conductors and bonds to the aluminium bands and thus to the sheath. The same resins can be used for making air blocks in lead-sheathed cables but in this instance no special measures are needed to provide a bond to the sheath since the differential expansion between lead and the resin block with temperature change is very much less than that between polythene and resin.

Air blocks are made wherever possible with the cable section in a vertical position so that the resin can simply be poured into the open end of the sleeve. If this is not possible, the sleeve is

sealed at both ends and the resin mixture is injected through a hole in the top of the sleeve. A funnel, shaped like an open-ended tooth-paste tube, is screwed over the hole and the sealing compound is poured in. The open end of the funnel is then sealed and wound down with a key until the sleeve is filled.

When the cable to be sealed contains plastic-insulated conductors, the resin has to be injected under between 10 to 15 lb a square inch air pressure, and a foot pump is used to force the compound from a transluscent polythene bottle into the sleeve.

When the sleeve is filled the bottle is removed and a polythene tube is attached to the entry hole and then filled with the resin. Because of the large surface area of the tube, the sealing compound in it dissipates much of the heat generated by the chemical action of the resin and hardener components so that the compound remains liquid longer than the compound in the sleeve thus providing a reservoir to fill any voids due to shrinkage. When the resin in the tube has hardened the tube is removed and the filling hole is sealed with a metal cap.

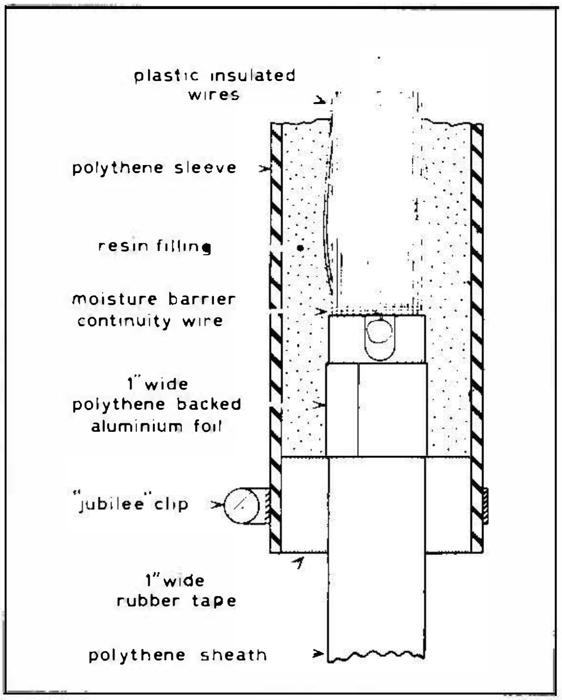
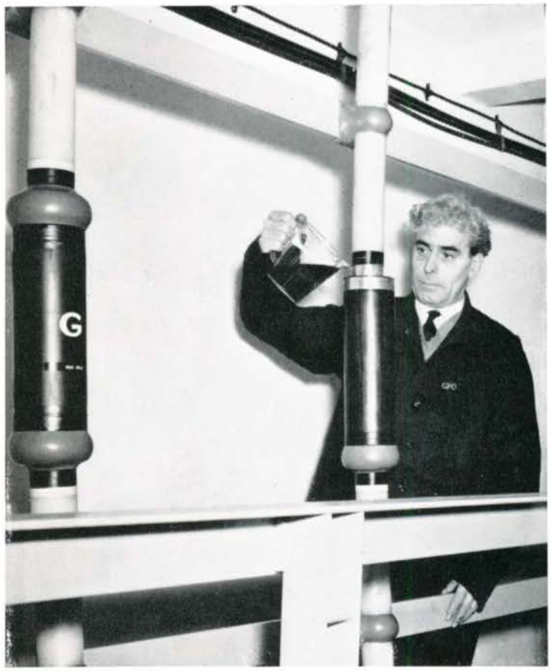


Diagram showing seal of terminating cable.



Liquid epoxis resin is poured into the open end of the sleeve of a vertical air block in a large size polythene insulated and polythene sheathed cable.

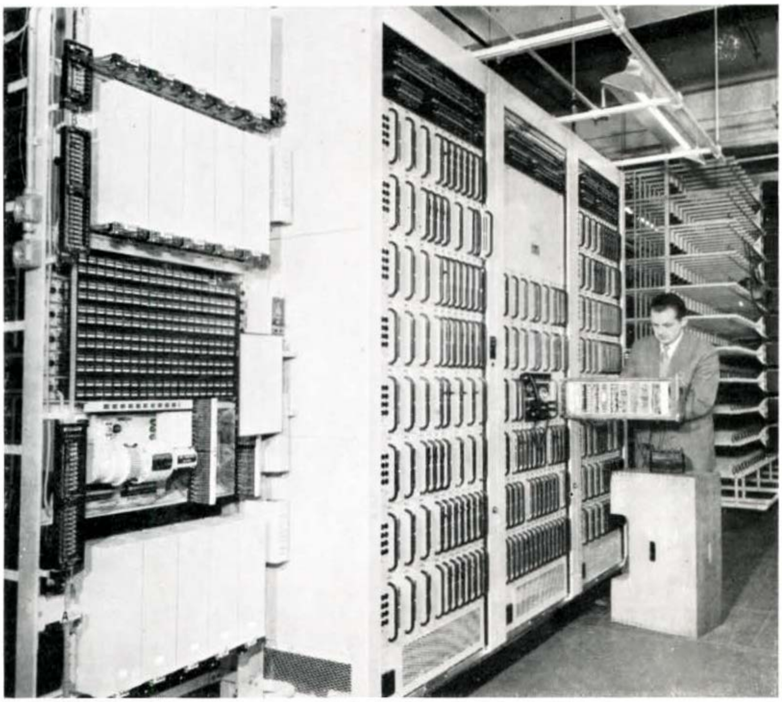
In modern polythene-insulated subscribers' cables, air leakage between the outside of the conductor insulation and the resin block is negligible, but in some of the polythene-insulated trunk cables and early subscribers' cables, the danger of leakage is much greater. For this reason air blocks in these cables are avoided, and where possible, are placed where paper-insulation exist because paper readily absorbs the resin compound.

As the *Journal* went to press arrangements were being made for air blocks to become an integral part of cabinet and pillar assemblies, thus eliminating in new work the difficult task of making air blocks in the congested conditions which exist in some manholes and joint boxes.

THE AUTHOR

Mr. H. E. ROBINSON *is an Executive Engineer in the External Plant & Protection Branch concerned with cable jointing. He joined the Post Office in 1923, as a Youth in Training. He has worked on the installation of new automatic exchanges in Bath and Bristol and on cable maintenance in the Bournemouth Telephone Area.*

A BIG STEP FORWARD AT LEAMINGTON SPA



An installation engineer makes a final check on the new electronic equipment at Leamington Spa. This unit is now serving 200 telephones.

THE introduction in March of experimental electronic exchange equipment at Leamington Spa marks an important milestone in the development of electronic exchanges for the British telephone network.

It is the first electronic unit to be used in public service following the decision in 1963 to concentrate future development resources on the space-division principle, using reed relays.

The unit at Leamington, designed and developed by the Post Office in collaboration with the British telephone industry under the auspices of the British Joint Electronic Research Committee, is serving 200 telephones and is being used in place of part of the existing and much larger electro-mechanical exchange. It is of the type designed for use in small exchanges and will provide all the advantages that electronics can give—including faster operation, lower running costs and smaller accommodation requirements.

The key component in the Leamington unit, as in the other British electronic systems under development, is the miniature reed-relay used for speech path switching and certain control functions. The reed-relay has four contacts, each gold-plated and protected from dust by a glass seal. The arrangement of reed-relays in the speech path switches is entirely novel and makes full use of the inherent design flexibility of the device. Outgoing calls are made through three switching stages, while four are used on incoming calls from other exchanges.

As the *Journal* went to press, arrangements were being made for a second trial unit to be installed at Peterborough. Both the Leamington and Peterborough units will provide the Post Office and the manufacturers with service experience of reed-relay switching systems suitable for exchanges serving up to 2,000 subscribers.

Further electronic exchange units of a similar type are being planned and an order has been placed for the first complete exchange, using equipment designed for exchanges of moderate capacity, which will be installed at Ambergate,

Derbyshire (800 lines) next year.

For electronic exchanges larger than 2,000 lines the Post Office and the industry are co-operating in the development of a somewhat different system but which also uses reed-relays. A prototype of this kind is now being installed at Leighton Buzzard for 3,000 lines.

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HAIL AND FAREWELL

THE *Journal* congratulates **Mr. D. A. Barron, CBE, MSc., MIEE,** on his recent appointment as Engineer-in-Chief of the Post Office.

Mr. Barron, an honours graduate of Bristol University, joined the Post Office in 1927. From then until 1940 he filled a number of posts in the Bristol, Plymouth and Liverpool areas, gaining a wide experience of both internal and external work. In 1940 he joined the Telephone Branch of the

Mr. D. A. Barron, the Engineer-in-Chief. Mr. Barron has been in the Post Office for 38 years.

Engineering Department, shortly afterwards taking charge of circuit and apparatus design. In 1945 he went to India where he planned the conversion of the Calcutta telephone service to automatic working and on his return led a working party on a world survey of automatic switching methods and plant which formed the basic study for the Subscriber Trunk Dialling system. Appropriately, the first STD exchange in Britain was introduced in 1958 in Mr. Barron's home town of Bristol.

For many years Mr. Barron was closely associated with the International Telephone and Telegraph Consultative Committee and was at various times chairman of several international groups on telephone matters. More recently, he has been prominent in the development of electronic telephone exchanges. An active member of the Institution of Post Office Electrical Engineers, Mr. Barron was chairman of the Council for some years from 1955. He became Deputy Engineer-in-Chief in 1960. Married, with one daughter, Mr. Barron lives at Beckenham and his main interests are philately and gardening.

The *Journal* joins his many friends in wishing **Sir Albert Mumford, KBE, BSc, MIEE, FQMC,** Engineer-in-Chief until last March, the happiest of retirements.

Sir Albert, a graduate of Queen Mary College, University of London, had a number of notable achievements to his credit. Soon after joining the

Sir Albert Mumford. He was Engineer-in-Chief for five years from 1960.

Post Office in 1924 he was posted to the Radio Laboratories at the Research Station where he played a major part in the early development of short and ultra-short wave telephony. Later he was involved in developing the first high power long-wave telegraph transmitter at Rugby Radio Station; the first trans-Atlantic radio-telephony service opened in 1927; and the first multi-channel telephone and television transmission over coaxial cables in Britain. He was also responsible for the introduction of remote controlled short-wave radio transmitters at the Rugby Radio Station, a technique now universally applied in modern radio stations.

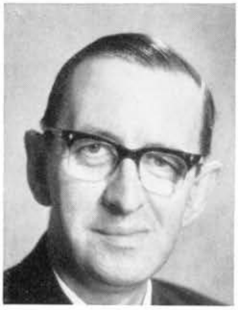
Shortly after World War Two Sir Albert (he was knighted in 1964) led United Kingdom delegations at a series of international conferences which drew up new radio regulations, including a new frequency allocation table. Sir Albert, who has contributed extensively to the work of the Institute of Electrical Engineers and became its President in 1964, lives at Wembley Park and has two sons, both of whom are engaged in engineering.

Succeeding Mr. Barron as Deputy Engineer-in-Chief is **Mr. J. H. H. Merriman, OBE, MSc, AInstP, MIEE,** who joined the Post Office in 1936 after graduating at King's College, University of London.

Mr. Merriman's career, which began at Dollis Hill Research Station, embraces experience of a

OVER

large number of subjects, including work on short-wave radio, very high radio frequencies in connection with multi-channel telephony and television; the planning and provision of radio links; and the use of electronic digital computers. In 1960 he took charge of the Overseas Radio Planning and Provision Branch and later the Inland Radio



Mr. J. H. Merriman, the new Deputy Engineer-in-Chief.

Planning and Provision Branch and for a time was Vice-chairman of the International Radio Consultative Committee Study Group on broad-band micro-wave radio relay systems. Appointed Assistant Engineer-in-Chief in 1963, Mr. Merriman has more recently been concerned with work on satellite communications and with the Post Office ground station at Goonhilly Downs.

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A BOOK FROM RUSSIA

PROFESSOR A. A. Kharkevich's recently-published book *Non Linear and Parametric Phenomena in Radio Engineering* (Iliffe Books Ltd., 35s.) is a translation from a monograph originally published in Russia.

The publisher's description of this new edition emphasises the importance of non linearities in transistor circuits and it is, therefore, somewhat suprising to find that there is no mention of the transistor in the text and that the many examples use only thermionic valves. Presumably, the original Russian version was published some years ago.

The distinction in the title of the book refers to those phenomena which can be described by non-linear equations and those phenomena described by linear equations with variable coefficients. The latter are often referred to as "parametric" effects. The different methods of analysis appropriate to these two classes of phenomena are explored by Professor Kharkevich in a clear manner while he restricts the mathematics to relatively simple concepts.

The most interesting parts of the book are the sections on modulation, rectification and detection but the short section on microwave oscillators seems quite out of place. The failure to include semi-conductor devices precludes a discussion on the various devices using tunnel diodes, or variable capacitance diodes (including "parametric amplifiers") which are of growing importance in modern communication engineering.

Although the monograph can be recommended as an introduction to the theory of non-linear phenomena, its usefulness to the student could have been greatly increased if the basic mathematical concepts had been applied to modern semi-conductor devices.

DR. H. N. DAGLISH

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AN HONOUR FOR SIR GORDON

Sir Gordon Radley, KCB, CBE, Director General of the Post Office from 1955-60 and President of the Institution of Electrical Engineers in 1956-57, was recently made a Commander of the French Order of Merit for Research and Invention.

Sir Gordon was nominated for the award by the Presidents of the Institutions of Civil, Mechanical and Electrical Engineers for his outstanding contributions in the fields of research and invention to the development of national and international telecommunications and in particular to the linking of continents by submerged telephone cables, incorporating electronic amplifiers.

LIEUT-COLONEL W. E. GILL

The late Lieut.-Col. W. E. Gill, Telephone Manager at Peterborough since 1952.

His many friends both inside and outside the Post Office will mourn the death at the age of 61 of Lieutenant-Colonel William Ernest Gill, TD, MIEE, Telephone Manager at Peterborough for the past 13 years.

Colonel Gill, brother of Mr. C. J. Gill, Vice-Director of the External Telecommunications Executive, joined the Post Office in 1920 as a Youth-in-Training. In 1929 he was appointed Acting Inspector at North Midlands District; a year later Inspector; in 1936 Chief Inspector at Coventry; and in 1938 Assistant Engineer in Glasgow.

After a distinguished career in World War Two—when he rose to the rank of Lieutenant-Colonel in the Royal Corps of Signals—Colonel Gill became Area Engineer at Chester and in 1952 Telephone Manager at Peterborough. Commissioned into the Royal Corps of Signals (Supplementary Reserve) in 1932, he served with the Territorial Army until 1957.

A NEW AID FOR THE DEAF AND BLIND

By Miss J. KELLY

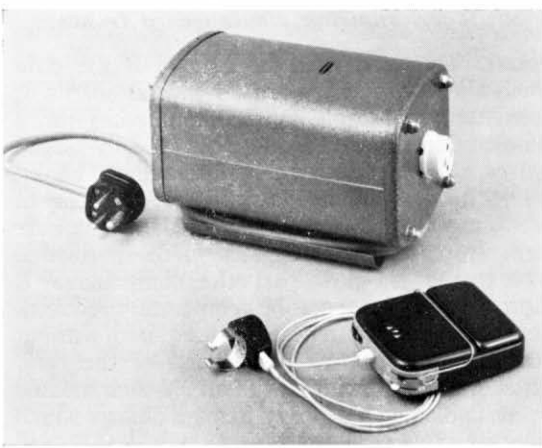
ONE of the biggest problems in the life of a person who is both deaf and blind is to know when a visitor calls at his home. A number of ideas, including electric fans and even sprays which emit a whiff of scent when the door bell-push is pressed, have been tried but all have failed.

Now, however, the answer has been found in a new electronic device, based on an idea put forward by a research engineer at the Post Office Research Station at Dollis Hill who is a member of the Scientific Development sub-committee of the Royal National Institute for the Blind. The device was developed by the RNIB.

The new device, which is simple to operate and relatively inexpensive to install and maintain, consists of two units: a series of loops of wire or copper strip which encircle the house and are connected to the bell-push and a mains-operated transmitter; and a pocket-sized transistorised receiver carried by the deaf/blind person which operates a tiny vibrator worn on the finger.

When a caller presses the bell-push the transmitter feeds current into the loops of wire or copper strip and a magnetic field is set up thoughout the house. This magnetic field is picked up by the receiver which operates the vibrator and warns the wearer that someone is at the door. Experiments have proved that the finger is one of the most highly-sensitive parts of the body for receiving such signals.

When the doorbell is pressed, the message is picked up by the finger-vibrator. The system will be a boon to a busy deaf/blind housewife.



The transmitter (above), to which is connected the induction loop circuit, with the transistorised hearing-aid receiver and vibrator.

Trials of the new device have been carried out by the Royal National Institute for the Blind and have proved completely successful. Mr. A. R. Sculthorpe, Secretary of the National Deaf/Blind Helpers' League, who is himself totally deaf and blind, has been using the system for the past 18 months and says it is an unqualified success.

The Ministry of Health have now invited a number of local authorities in England and Wales to take part in extended practical trials for which the Ministry will supply the receivers and vibrators.

This welcome new aid for the handicapped may eventually have other important uses. For example, by introducing a series of signals in the form of a code a whole range of messages could be sent. The system could also conceivably be used as a burglar alarm to warn a night-watchman of the approach of an intruder when the loop circuit is broken.

A NEW EQUIPMENT DESIGN

By H. F. LLOYD

Soon to come into general service is a new type of equipment design which has many advantages over its predecessors, not the least of which are the possibilities for exports

A partially-equipped new double-depth type 62 rack with a card in its hinged outrigger, showing sloping card fronts.

A NEW type of equipment design which is cheaper to make and install and has many other advantages over that it replaces, is being brought into service at repeater stations.

This new form of construction—known as the 62-type Equipment Practice—will replace the 51- and 56-type and, like its predecessors, takes its name from the year in which the decision to change to a new standard was made.

As it became apparent that the transistor would replace the valve and that associated components would also become smaller, it was clear that the old scheme of installing a completely factory-built rack would have to be changed, since, in many instances a rack could now house much more equipment than was originally required and it was very difficult to add equipment to an installed and operating rack.

The new rack is a double-depth type, all equipment being mounted from one side only and with cabling access on the other, instead of the old back-to-back single-depth system which made cabling access difficult. It consists of three major parts: the rack framework, shelves and cards.

The rack framework has two rows of slots in each side to hold the brackets on which the shelves are slid. The normal shelf is six inches high, but the slots are provided at every two-inch interval (instead of one-and-three-quarter-inch intervals in the previous design) so that other shelf heights can also be used.

The shelf has a number of card guides and carries sockets at the back. The cards slide into the guides and carry plugs which mate with the sockets. The card itself is a metal frame onto which a large printed board, or several boards or sealed cans and so on, can be mounted. Thus, a completed rack holds a number of vertically-placed shelves, each with several cards like a row of books.

The new equipment rack has a number of interesting features. For example, the shelves are normally placed at 15 degrees to the horizontal so that the air flow past the components is improved and the operating temperature reduced. Horizontal shelves can be used, if required, without changing the cards or other parts of the rack. Cards of different widths with an 0.2-inch module are available and for heavy items a chassis which slides into two card guides is used.

On the new equipment, external cables sweep straight down the rear cable space and terminate directly on the appropriate socket connection

instead of at the top of the rack, thus reducing the number of joints in a circuit—a feature which should produce greater reliability. Because most cards are plugged in, the plugs and sockets must be as reliable as possible and for this reason they are gold-plated to a stringent performance specification. The mouldings have a capacity of 40 contacts but, to reduce costs, only the number actually required will be fitted.

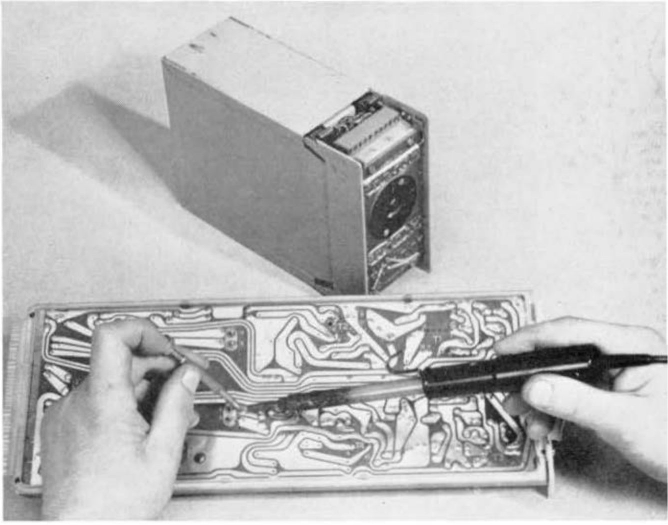
Mouldings are also available to take a combination of normal contacts and coaxial connectors and these, too, are gold-plated and fitted only where needed. A card and its plug and socket are required to have insertion and withdrawal forces not greater than 30 and 18 lb respectively. There is also an outrigger which plugs into the shelf socket and provides a socket and the support for a card so that it can be worked on while extended in front of the rack.

The power units, which provide a stabilised 20-volt supply for the equipment, are mounted in one or other of the two top shelves, together with the associated alarm relays and fuse cards. The rest of the equipment then grows down the rack. Three different power units, which are interchangeable and occupy a quarter of a shelf each, have been designed so that equipment can be driven from a normal 24-volt battery, a 50-volt battery or an AC mains supply.

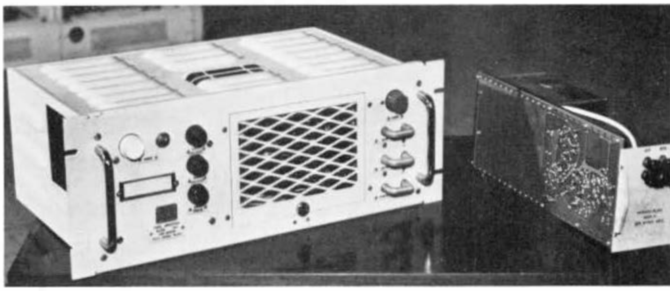
Each shelf incorporates a simple card lock which requires a deliberate—and, it is hoped—a thought-provoking action before a card can be removed. The fuse card has a maximum capacity of 30 fuses. The normal plug and socket cannot be used since it is necessary to have access to any one fuse without disconnecting the rest. For this and similar applications an extensible cable form between the card and the rack cable is required and a flexible printed wiring technique may prove to be the best solution.

Finally, the new 62-type rack has been designed to use a minimum of different parts which do not require the use of elaborate tools. Steps have been taken to ensure that parts made by different manufacturers mate together.

Post Office engineers are already considering factors which may affect future equipment designs. Since equipment is now being designed which occupies still less space, the present card, which measures 12 inches by six inches, is too large for such applications as channel translation. It will soon be possible to have two channels on this area and it is obviously desirable to be able to work



Above: Removing a multi-tagged component from a 62-type card with a special tool. A 56-type unit is shown for comparison. Below: A 62-type video amplifier which uses transistors instead of valves.



on one without disturbing traffic on the other. A possible development, therefore, is to use a central, double-sided runner on a card guide and to have two cards, each measuring 12 inches by three inches in the existing shelf. Another method would be to have a flexible connection and fit two or more items on the same card. Shelves other than those six inches high could, of course, be developed.

For some years it was thought that the use of transistors in place of valves would produce equipment which runs at much cooler temperatures. In fact, the reverse is rapidly becoming the case. Transistors have encouraged component designers to make their products smaller so that assembled equipment becomes smaller each year with no similar reduction in power dissipation. Unless

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A NEW EQUIPMENT DESIGN (*Contd.*)

space is to be wasted and a rigid discipline enforced on designers of both equipment and repeater stations, some form of air-conditioning and controlled ducting of air—or even a form of built-in refrigerator—will become essential. The effect of this on the 62-type equipment design will depend on the dissipation to be permitted. At present, an average of 150 watts for each rack is allowed, but if this figure were multiplied five-fold the whole rack would have to be put into a cabinet with air led in at the bottom and out at the top with none escaping into the station.

The decision to change to the new standard form of construction will bring many advantages to the Post Office and the contractors and open up considerable possibilities in the export field. The new design may not be aesthetically pleasing to everyone but it can be confidently predicted that the 62-type will be standard form of construction in the British Post Office for at least as many years as enjoyed by its predecessors.

THE AUTHOR

Mr. H. F. Lloyd, BSc (Eng), AMIEE, is Senior Executive Engineer in the Main Lines Development and Maintenance Branch who joined the Engineering Department as a Youth in Training at Rugby Radio Station in 1940. He was made an Executive Engineer at Dollis Hill in 1946 and was engaged on the development of television transmission equipment. He later spent six years at the Central Training School at Stone.

In LMD since 1961, he was first responsible for the maintenance of high frequency line transmission and latterly for the development of common user items in line transmission and for certain aspects of television transmission and switching apparatus.

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IPOEE ESSAY WINNERS

Essays by Mr. S. D. Ayers, Technical Officer from Plymouth, and Mr. L. H. Mockridge, Technical Officer from Bournemouth, were judged equal first in the Institution of Post Office Electrical Engineers' 1964-65 Essay Competition. Each received a prize of £6 6s. and the Institution's Certificate. The title of Mr. Ayers' essay was "From Tom-Toms to Telstar" and of Mr. Mockridge's essay "A Youth and Varley's Disciple."

Prizes of £3 3s. and Institution Certificates were awarded to the following Technical Officers: Mr. K. L. Garraway, of Maidenhead; Mr. G. D. Cumming, of Belfast; and Mr. P. J. Froude, LPR. Five competitors, all Technical Officers, won Institution Certificates of Merit: Mr. A. G. Hickson, Northampton; Mr. A. L. Deighton, of Grimsby; Mr. R. Brewer, Newark-on-Trent; Mr. P. J. R. Evans, Ramsgate; and Mr. K. J. Burfitt, Cardiff.

The judges of the competition were Mr. R. O. Boocock, Mr. T. J. Rees and Mr. D. G. Jones.

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Sir Ronald German, Director-General of the British Post Office, was chairman of the Commonwealth Telecommunications Conference which opened in London on 26 April to consider the pattern of Commonwealth co-operation in telecommunications. About 20 Commonwealth countries were represented and among the subjects they discussed was communications by satellite.

The Conference will prepare a report for consideration by the Commonwealth Governments.

MORE MECHANISATION

Mechanisation of the Overseas Telegraph Service was taken a step further in January, when an order was placed with the MEL Equipment Company for the supply and installation in Cardinal House, Farringdon Road, London, of a message relay unit based on their system ES 2/3. Large private companies who use this type of equipment include British European Airways and the Shell Company of London.

The message relay unit will be basically a semi-automatic switching system, that is an operator will determine from particulars of the message heading displayed before him, and by press-button selection, the onward routing of the message. It will also be capable of conversion to switching automatically any message presented to it in the internationally agreed format for message retransmission.

The initial designed capacity of 3,000 messages in the busy hour provides for the connection of 50 overseas channels and 60 inland channels and the new unit will eventually replace the torn tape relay unit (OTRU) which has been in operation in Electra House, London since January, 1964.

A. T. GRAY

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"The Post Office is to embark on a thorough-going review of measures against the evasion of the law on licensing of radio and television sets," said the Assistant Postmaster General, Mr. J. Slater, in a recent written answer in Parliament. In the 12 months ending in March, 1965, more than 21,500 people in Britain were successfully prosecuted for radio and television licence fee evasion.

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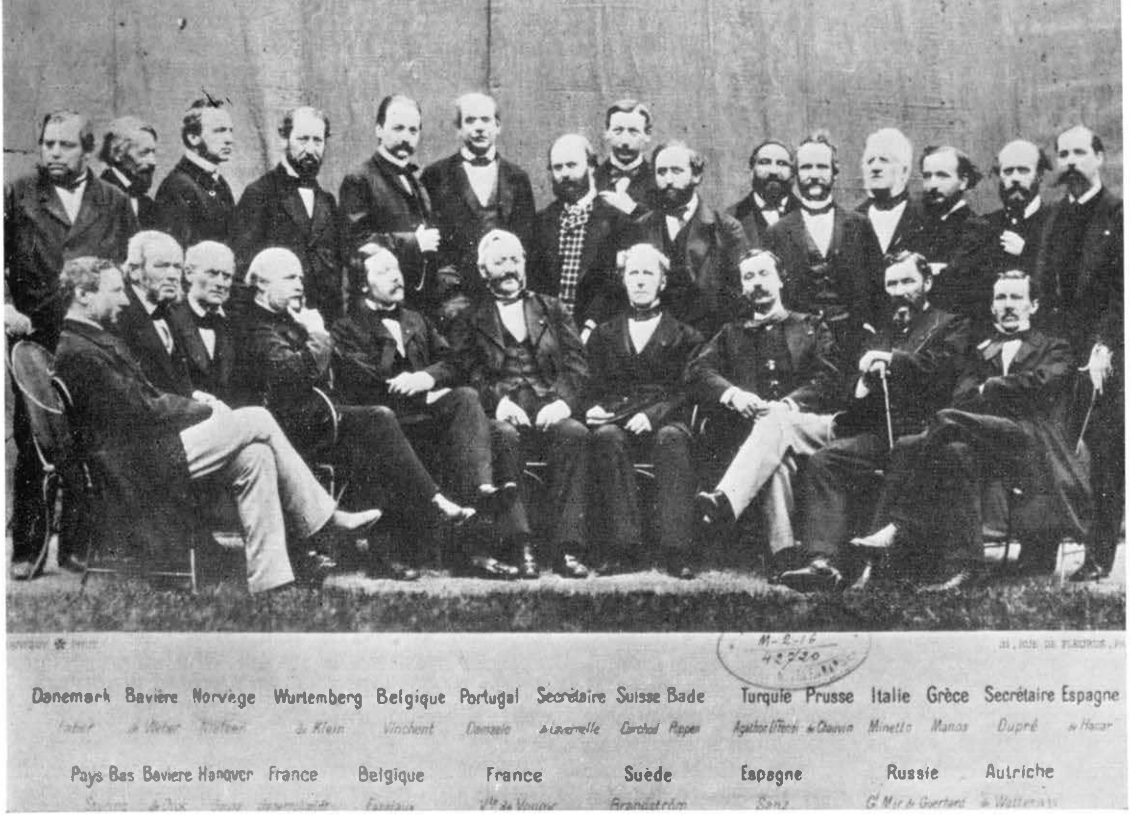
Anvil, Floral, Galleon, Globe, Hudson, Ismay and Ivydale are the names which have been selected for telephone exchanges which will be opening in London in the near future.



Representatives from 20 nations (some of them seen above) met in Paris 100 years ago. After 16 meetings they established a common agreement on international telegraph services and paved the way for . . . . .

A CENTURY OF CO-OPERATION

THE International Telecommunication Union—universally known by its initial letters as the ITU—celebrates its centenary this year. Its story, spanning the most significant hundred years in the history of communications, is one of dedicated effort to achieve, maintain and extend international co-operation throughout the entire field of telecommunications.

The ITU was formed on 17 May, 1865, at a Convention in Paris called by Napoleon the Third of France to consider how the then new-fangled electric telegraph system could be internationally operated and controlled. In those days, international telegrams had to be written down on a piece of paper and carried across the borders of neighbouring countries by messengers and there was no arrangement for dividing the charges of the telegrams between the countries which carried them. Representatives from 20 nations—among them delegates from Saxony, Wurtenberg, Baden and Turkey, the latter travelling part of the way on horseback—attended the first Convention. Britain, because its telegraph services, unlike those of most other European countries, was still in private hands, was not represented.

The first Convention, after 16 meetings, succeeded in hammering out a set of common rules for Europe's international telegraph system. Uniform tariff rates were agreed, except for the easternmost parts of the Russian and Turkish empires, and the French gold franc was made the currency for payment of international accounts.

This first Convention was followed in 1868 by a second Convention in Vienna which reached a decision of almost equal importance in the history

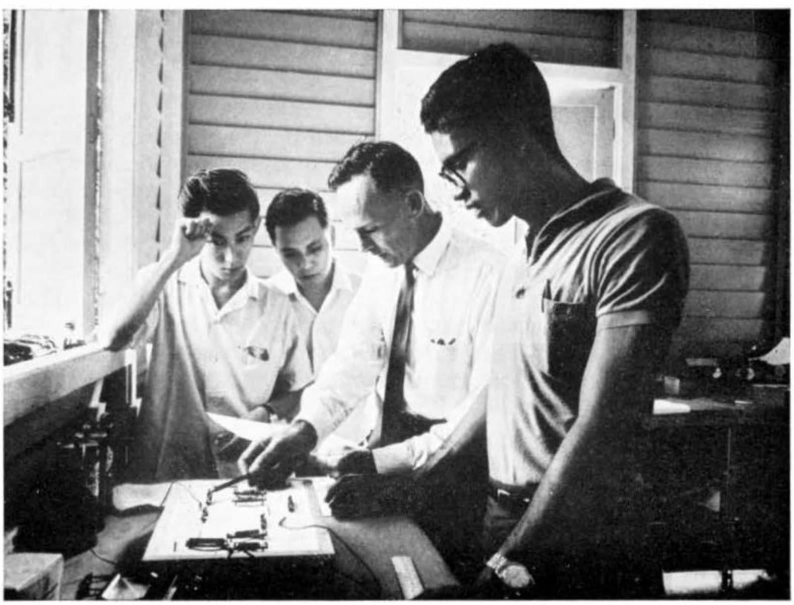
of international organisations: it set up a headquarters with a Secretariat. The headquarters, then composed of a staff of three Swiss, was established in Berne as the Bureau of the Union and remained under the control of the Swiss Government until 1947.

Throughout the remainder of the 19th century the ITU worked steadily ahead, wrestling with legal and financial problems, revising and redrafting international telegraph regulations and, among a host of other things, drawing up rules which forbade the sending of telegrams which "offended public order or decency." In 1885 the ITU formulated the first legislation for the international use of the telephone which had been brought into use in 1876 by Alexander Graham Bell.

From these relatively small beginnings, the work of the ITU began to take on an ever-increasing scope and importance. In 1895-96, after decades of research and experiment, the first successful wireless transmissions were made and almost overnight this new form of communication spread across the international scene, for the first time bringing ships at sea within the reach of telecommunications. It soon became clear that international regulations were needed for radio communication, particularly when, in 1902, Prince Henry of Prussia, returning across the Atlantic from the United States, tried to send a message to President Theodore Roosevelt, only to have it refused because the radio equipment on board the ship was of a different type from that at the shore station. Mainly as a result of this incident the German Government called a preliminary radio conference in Berlin in 1903 which prepared the way for the ITU's 1906 Berlin Radio Conference. This Conference drew up the first international radio regulations which, among other rules, incorporated the principle that ship and coastal radio stations must be able to accept messages from each other and laid down the international SOS distress signal.

Broadcasting, which began in 1928, presented new international problems and taxed the ITU with the task of allocating radio frequencies—a task which today remains one of the Union's main responsibilities. The first move to solve this problem was made at the Washington Radio Conference in 1927 when bands of frequencies were allocated to each of the different radio services.

The ITU evolved as a single entity under its present title at a Convention in Madrid in 1932. In 1947, following two conferences in Atlantic City, it became a specialised agency of the United Nations and its headquarters were transferred from Berne to Geneva.



A fine example of international technical co-operation: students from many countries receive instruction at the training centres operated by the ITU and the United Nations Special Fund for the trainee engineers.

Today the ITU headquarters is composed of four permanent bodies—the General Secretariat, the International Frequency Registration Board and two International Consultative Committees: the CCIR for radio matters and the CCITT for telegraphy and telephony.

With the advent of the space age the ITU is faced with a new challenge and to meet this new demand more than 6,000 megacycles, about 15 per cent of the entire radio frequency spectrum, were allocated for outer space at a world Space Radiocommunication Conference held in Geneva in 1963.

The remarkable achievements of the ITU in the past hundred years are reflected in much more than the international regulations it has drawn up to govern the operation of telegraphy, telephony and radio. They are reflected, too, in the acceptance by member countries of the radio frequency allocations which determine the assignments they themselves make to their own radio stations; in the drawing up by the ITU Plan Committee of a blue-print for a future world-wide network by which telephone subscribers anywhere will be able to dial calls direct to any other subscriber anywhere else in the world; and by no means least, in the Union's technical co-operation organisation which is training engineers in the new countries in the most up-to-date techniques of telecommunications.

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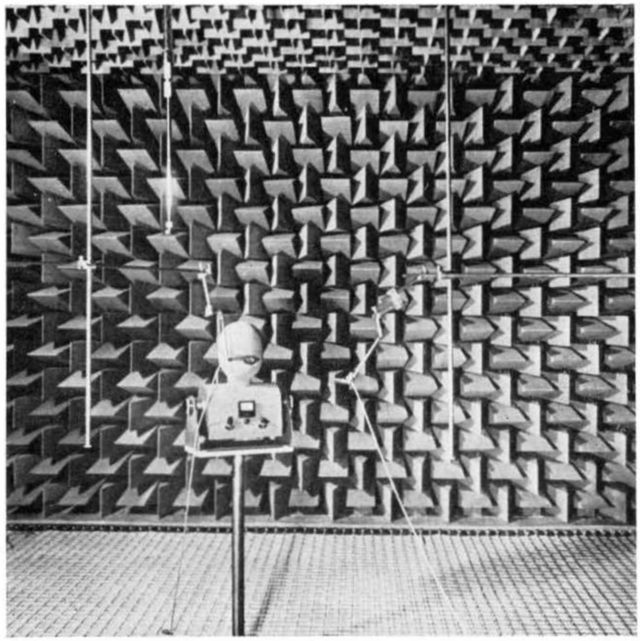


Above: An artificial mouth measures the sensitivity of a telephone sending system in the sound-proof room of the ITU's laboratory in Geneva.

Below: The ITU Headquarters at the Place des Nations in Geneva.

Today, the ITU has 127 member countries. Some of the representatives are seen here at the opening of the ITU's Space Radio-Communication Conference at Geneva in 1963.

HOW THE ITU WORKS

- *Today, the ITU boasts a membership of 127 countries and one associate member, the Republic of Zambia. Great Britain has been a leading member since 1871.*
- *The member countries now meet every five years or so at a Plenipotentiary Conference, the supreme authority of the Union, which is ultimately responsible for general policy and which revises the Convention, if necessary, and elects the Secretary-General, Deputy Secretary-General and the Administrative Council of 25 members.*
- *The Administrative Council normally meets for a month once a year at Geneva, acting for the Plenipotentiary Conference between the latter's meetings. It supervises administrative functions, co-ordinates the activities of the four permanent bodies of the ITU headquarters and examines and approves the annual budget.*
- *Three kinds of administrative conference are held by ITU member countries: ordinary administrative conferences, extraordinary administrative conferences, and special conferences. The ordinary conferences fall into two categories: one to deal with radio matters and the other telegraphy and telephony. In addition, the radio conferences elect the members of the International Frequency Registration Board and review the Board's activities. Extraordinary and special conferences are called to discuss special telecommunications matters or to revise parts of a set of regulations.*

TO commemorate its centenary year the ITU held a special ceremony in Paris on 17 May—the date exactly 100 years ago on which the Convention creating the ITU was signed in that city. A Plenipotentiary Conference will meet at Montreux, Switzerland, between 14 September and 12 November. This will be only the ninth occasion in the ITU's history that a Plenipotentiary Conference has met, the previous occasions being Paris, in 1865; Vienna, in 1868; Rome, in 1871-72; St. Petersburg, in 1875; Madrid, in 1932; Atlantic City, in 1947; Buenos Aires, in 1952; and Geneva, in 1959.

A sculpture competition sponsored by ITU to commemorate its centenary offers 5,000 Swiss francs for the best sculptural decoration to adorn the north end of the ITU building in the Place des Nations, Geneva, should the work not be commissioned within twelve months of the date of prize winning the winner will be entitled to an additional prize of 20,000 Swiss francs.

The ITU is also publishing a special commemorative book entitled *From Semaphore to Satellite* and many member countries are issuing special commemorative stamps.

The commemorative stamps issued by the British Post Office are printed in five colours. A 9d stamp, bearing a symbolic design of world telecommunications stations, is in pink, blue, red, black and violet. The 1s 6d stamp, featuring, also symbolically, a radio or sound wave and a representation of a switchboard, is in a variation of the same colours.

The 1s 6d commemorative stamp issued by the British Post Office on the occasion of the ITU centenary. It is in five colours.

Telecommunications Statistics

(Figures rounded to nearest thousand.)

	Quarter ended 31 Dec., 1964	*Quarter ended 30 Sept., 1964*	*Quarter ended 31 Dec., 1963*
Telegraph Service			
Inland telegrams (including Press, Railway Pass. Service and Irish Republic)	**2,818,000**	3,522,000	2,858,000
Greetings telegrams	**611,000**	754,000	629,000
Overseas telegrams:			
Originating U.K. messages	**1,724,000**	1,915,000	1,663,000
Terminating U.K. messages	**1,697,000**	1,871,000	1,665,000
Transit messages	**1,432,000**	1,264,000	1,346,000
Telephone Service			
Inland			
Gross demand	***264,000**	186,000	165,000
Connections supplied	***180,000**	159,000	150,000
Outstanding applications / Orders in hand	**165,000**	173,000	167,000
Total working connections	**5,904,000**	5,797,000	5,532,000
Shares service connections (Bus./Res.) ...	**1,151,000**	1,135,000	1,102,000
Total effective inland trunk calls	**184,783,000**	186,934,000	158,261,000
Effective cheap rate trunk calls	**39,171,000**	44,943,000	33,638,000
Overseas			
European: Outward	**†1,559,000**	1,496,000	1,178,000
Inward	**†1,258,000**	1,206,000	1,124,000
Transit	**†12,000**	12,000	13,000
Extra European: Outward	**†141,000**	129,000	108,000
Inward	**†193,000**	165,000	135,000
Transit	**†26,000**	19,000	18,000
Telex Service			
Inland			
Total working lines	**14,000**	14,000	12,000
Metered units (including Service)	**41,359,000**	39,421,000	31,555,000
Manual calls from automatic exchanges (including Service and Irish Republic) ...	**16,000**	48,000	38,000
Overseas			
Originating (U.K. and Irish Republic) ...	**†2,316,000**	2,205,000	1,854,000

*New style statistics from Sept. 1964. Terms "Current Demand" and "New Supply". †Includes estimated element.

ERRATA.—It is regretted that the overseas statistics were incorrectly presented in the Spring 1965 issue. The figures appearing under the headings 30 Sept., 1963 and 30 Sept., 1964 were transposed.

Publication and Price. The *Journal* is published in February, May, August and November, price 1/6. The annual postal subscription rate is 6/6 to any address at home or overseas.

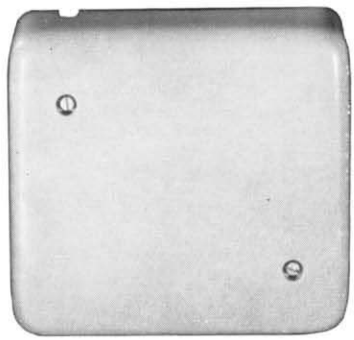
Contributions. The Editorial Board will be glad to consider articles of general interest within the telecommunications field. No guarantee of publication can be given. The ideal length of such articles would be 750, 1,500 or 2,000 words. The views of contributors are not necessarily those of the Board or of the Post Office.

Communications. Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, GPO Headquarters, St. Martin's-le-Grand, LONDON, E.C.1. Telephone: HEAdquarters 4345. Remittances should be made payable to "The Postmaster General" and should be crossed "& Co.".

GPO

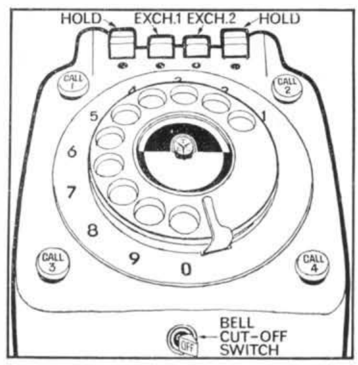
take five of these...

and one of these...



and you have a complete 2+5 Keymaster system

In the modern, compact business the surrender of space to a switchboard, and the allocation of staff duties for its surveillance, are equally unacceptable. The 2+5 'Keymaster' system provides a basis of communication free from these disadvantages. The development of the 2+5 'Keymaster' has resulted in a notably compact system, simpler to operate than its predecessors and of unusually low installed cost. The facilities offered include all those likely to be required by an intermediate-sized business and are comparable with those hitherto associated with appreciably larger desk units and much more complex central apparatus. An important feature of the system is the low operating voltage. Six-volt power requirements may be derived from dry batteries or a mains operated power unit. Normally, provision is made for 5 stations, but 7 stations and other variations are available. For further information please contact Sales Dept. Ericsson Telephones Ltd., Beeston, Nottingham.



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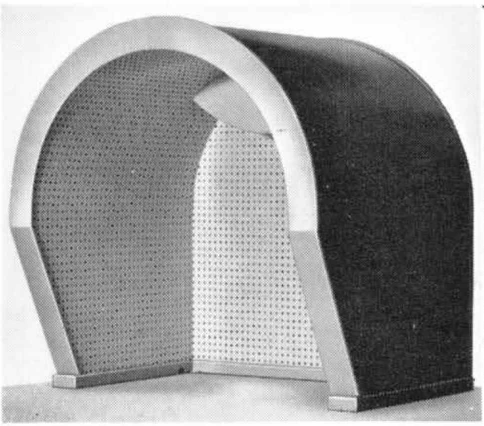
ER102A

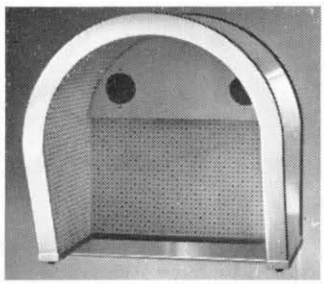
WHITELEY
for acoustic hoods

All noisy environments such as factories, workshops, department stores and hotels require the facility of an acoustic hood which permits telephone conversations to be held without the interference of annoying background noises.

Whiteley acoustic hoods are strongly made from resin bonded ply and finished in a cellulose enamel which makes them suitable for indoor or outdoor use.



Standard Hood Dimensions
25″ high × 20¼″ deep × 24½″ wide



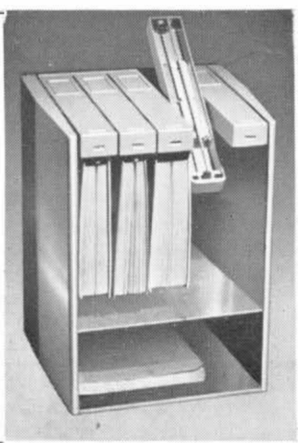
Fitted with loudspeakers

Fitted with doors for outside use

Also available with internal light and/or a storage shelf below hood.

& directory holders

Directory Holder dimensions
17¼″ high ×
13½″ wide ×
13⅝″ deep



These attractive, and extremely functional, directory holders will hold five directories neatly and securely, in individual swivel holders permitting easy identification and reference. The lower shelf provides additional storage space. The units are of cast alloy, finished in an attractive grey epoxy resin enamel and constructed to strict G.P.O. design specifications.

For further details please write or telephone:—

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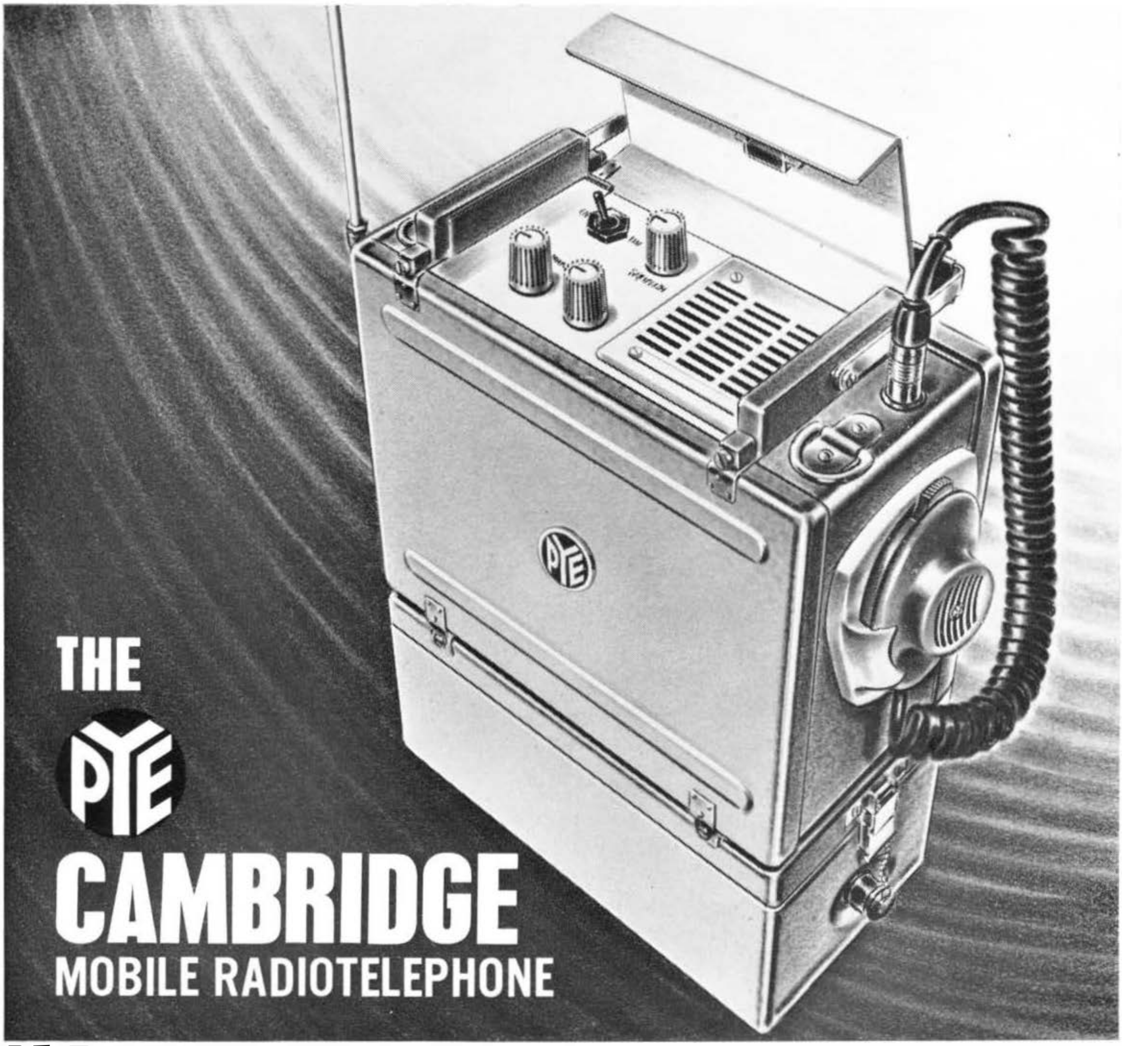

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At last—a compact, transistorised V.H.F. radio-telephone with all the power and performance of vehicle mobiles. The rechargeable battery gives up to *60 hours* duration on receive and about *18 hours* with normal use of the transmitter. The whole unit is completely weatherproofed, and is available for A.M. or F.M. systems. There is also a marine version. The answers to your questions are waiting at the address below.

- Frequency range 25 to 174 Mc/s.
- Fully transistorised receiver.
- Standby battery drain—200mA.
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- Sealed I.F. block filters.
- Electronic Squelch.
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- 1 to 6 channels as required.
- Available with an additional A.C. Power Unit.
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Marconi Self-Tuning H.F System
—the first in the world to be station
planned from input to output.

breakthrough

MST drive systems for h.f transmitters

MST drive systems meet all CCIR Recommendations

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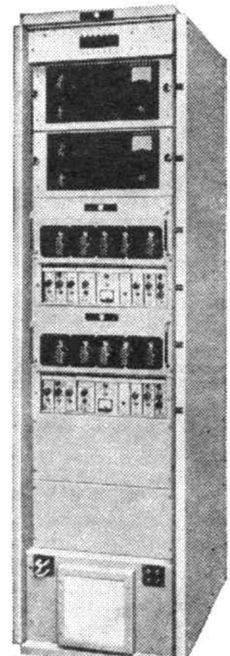
Comprehensive synthesizer drive assembly for two independent transmitter channels
Inputs: audio frequencies (6 kc/s bandwidth) or d.c
Outputs: modulated signals at radiated frequencies, 2 W p.e.p
Types of modulation: i.s.b with floating carrier, pilot carrier or fully suppressed carrier; d.s.b; c.w 400 bauds; f.s.k 200 bauds or 3,500 bauds; frequency shift diplex
Frequency range: 2—27,9999 Mc/s
Frequency selection by decade dials on frequency synthesizers
Stability: determined by 1 Mc/s master frequency

H1605

1 Mc/s master frequency source
Frequency stability: $\pm$ 1 part in 10^8



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one-man control

With the compact MST drive system, self-tuning transmitters and MST control and monitoring equipment, one man can operate an entire transmitting station from a central point.

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All units (exceptthe distributed amplifier) are fully transistorized and use printed wiring. Each unit has a separate power supply. The 1 Mc/s master signal distribution is duplicated, and the master frequency source uses three oscillators to ensure immediate automatic changeover in the event of output failure or excessive frequency drift.

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Any drive channel can generate any type of modulation. F.S.K and f.s diplex signals generated by shifting the frequency of 2 kc/s or 4 kc/s tones —thus one transmitter can radiate simultaneously two or more telegraph channels and an s.s.b channel.

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